

A general approach to length-weight relationships for New Caledonian lagoon fishes

by

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ABSTRACT. - Most studies involving Pacific reef fishes use underwater visual censusing techniques to estimate their biomass and stock. This requires to know the length-weight relationships of all the species censused. Currently, only a small proportion of these relationships (15.4%) are available for reef fish species in the Pacific area. In the present article we propose length-weight relationships at four organisation levels: species, genera, families and morphological groups. A data base of 53,800 specimens belonging to 788 species from New Caledonia were used to estimate the relationships for 396 species, 185 genera, 75 families. At the genus level, the length-weight relationships cover 76% of the Pacific reef species and the coverage is nearly 85% at the family level. A study of the morphology of 1,100 specimens belonging to 311 species allowed to define 30 morphological groups, for which length-weight relationships were then estimated using 32,551 specimens belonging to these species. Using 3 classes of body thickness, a second clustering of these species defined 20 groups allowing length-weight relationships to be estimated from 2D pictures. These relationships allow to estimate weight from length data for most of the species not covered by the relationships at the species, genus or family level. The error levels increase from the species (average error 9.4%) to the family level (13.5%), the morphological groups yielding errors equivalent to those from the family level equations (13.2%). A graphical analysis of the coefficients from 396 length-weight relationships suggests that there are physical limits to fish shapes.

RÉSUMÉ. - Approche généralisée des relations longueur-poids des poissons lagunaires de Nouvelle-Calédonie.

La plupart des études visant à estimer la biomasse ou les stocks de poissons récifaux de l'Indo-Pacifique utilisent des méthodes de recensement visuel en plongée. Cela exige de connaître les relations longueur-poids de toutes les espèces recensées. À l'heure actuelle, seule une faible proportion de ces relations (15,4%) est disponible pour les espèces récifales du Pacifique. Notre article fournit des relations longueur-poids à quatre niveaux d'organisation : espèces, genres, familles et groupes morphométriques. Une base de données comportant 53800 poissons appartenant à 788 espèces de Nouvelle-Calédonie a été utilisée pour estimer les relations pour 396 espèces, 185 genres et 75 familles. Les relations longueur-poids au niveau générique couvrent 76% des espèces récifales du Pacifique et au niveau familial la couverture atteint 85%. Une étude sur la morphologie de 1100 spécimens appartenant à 311 espèces a permis de définir 30 groupes morphométriques pour lesquels des relations longueur-poids ont été estimées sur la base de 32551 spécimens appartenant à ces espèces. Une seconde classification de ces espèces fondée sur 3 classes d'épaisseur du corps permet de définir 20 groupes à partir desquels les relations longueur-poids peuvent être estimées en utilisant des images 2D. Ces relations permettent d'estimer le poids à partir de données de longueur pour la plupart des espèces pour lesquelles on ne dispose pas de relation au niveau espèce, genre ou famille. Les niveaux d'erreur augmentent de l'espèce (erreur moyenne 9,4%) jusqu'à la famille (13,5%), les groupes morphométriques comportant un niveau moyen d'erreur équivalent à celui de la famille (13,2%). L'analyse graphique des coefficients des relations longueur-poids de 396 espèces suggère qu'il existe des limites physiques aux formes que peuvent prendre les poissons.

Key words. - Reef fish - New Caledonia - Lagoon - Length-weight relationships - Morphology.

Our current knowledge on the biological traits of Indo-Pacific shore fishes is still very limited. In particular, length-weight relationships are only known for a restricted number of species. There are 5,480 taxa of inshore fishes reported so far from the tropical Pacific (Kulbicki *et al.*, 2004), but we have length-weight relationships for only 720 of them, i.e. 13% (the main source is Fishbase: Froese and Pauly, 2001; see also Kulbicki *et al.*, 1993; Yanagawa, 1994; Kochzius, 1997; Arias-Gonzales *et al.*, 1997, 1998; Letourneur *et al.*, 1998; Gonzales *et al.*, 2000; Khaironizam and Norma-Rashid, 2002). These values increase only slightly (15.4%) if the search is restricted to reef associated species (exclud-

ing the smallest Gobiidae and Trypterygiidae: 3,580 taxa and 553 relationships).

Length-weight relationships have many applications in fish stock assessments and ecological studies. They are of special interest for underwater visual censuses (UVC), in order to transform length data into weight data and, as a result, obtain biomass estimates (Samoilys, 1997). Most UVC surveys are performed on reefs by divers who record visual estimates of fish length. The use of video recordings is on the increase but still marginal. The accuracy of length estimates by divers has been the subject of many studies (e.g., Bell *et al.*, 1985; Bellwood and Alcala, 1988; Kulbicki,

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1990, 1997; Darwall and Dulvy, 1996), errors having potentially important consequences on biomass estimates as indicated by Bellwood and Alcala (1988). The precision of these length estimates varies according to authors, the most reliable study (Harvey *et al.*, 2001, 2002) indicating a precision of 8-16% by divers and < 1% by video cameras for a range of three species.

Biomass estimates for reef fish based on length estimates from UVC work are confronted with the problem of the absence of validated length-weight relationships for a large number of species. So far, there is no standardised procedure to attribute a length-weight relationship to a species for which it is lacking. Most authors use the relationship from a species within the genus or the family of the species of interest. At times they also use relationships from species, which have a similar morphology. However, no author follows an explicit protocol. It is difficult to assess the errors on biomass that these procedures will produce. One possible way to consider this problem would be to use length-weight relationships at the genus or family level. Unfortunately, few of these relationships are available because most studies give length-weight relationships only at the species level, and only a few (Bauchot and Bauchot, 1978) indicate relationships at a higher taxonomic level (genus or family). Averaging the values of the regression coefficients of length-weight relationships in order to obtain an average relationship for a genus or a family is statistically erroneous. It is, therefore, necessary to estimate these relationships at the genus or family level by considering the initial data on individuals. Unfortunately, this initial data is not available from the literature.

In the present article, we propose to create classes of fish inside which length-weight relationships are homogenous. Two ways of classification have been considered: according to phylogenetic criteria and according to morphological criteria. Such a choice has led to four levels of classification: by species, genera, families or by general morphological characteristics. Our purpose is to enable users to find the best length-weight relationship for any species, for which no validated relationship is available. The three first groups are based on taxonomic relationships because most species within a genus or a family tend to have similar shapes. Unfortunately, there are a number of exceptions to this trend and the data we have available do not cover all families or genera. We propose to use the morphological characteristics of a large number of species to define morphological groups, to which almost all Pacific reef species could be related. To achieve this goal the following steps are taken: (1) estimate species specific length-weight relationships, (2) estimate genus and family specific length-weight relationships, (3) explore the physical limits of these relationships, (4) identify discrete morphological groups using multivariate analysis, and (5) estimate the length-weight relationships for each morphological group.

MATERIALS AND METHODS

Morphological parameters

In order to group fish according to their morphology, weight and various morphological measures were taken on each fish specimen, as described on figure 1. This was done on a total of 1,100 fish, representing 311 species, 138 genera and 53 families. Fishes were caught by different methods: rotenone poisoning, spear-fishing, hand-line and gillnet. The sampling was operated from July to September 2003, on various sites and thus various biotopes in the south-eastern lagoon of New Caledonia. Neither geographical nor time influence was taken into consideration. Two to 8 specimens were used for each species. This low number of specimens per species is because morphometric measurements are at the basis of fish taxonomy and are very stable between individuals, as attested by the high correlations between them (e.g., Loubens, 1980).

Several measurements were performed on each fish: CH (Caudal Height), FL (Fork Length), SL (Standard Length), HL (Head Length), H33 (Height at the first third -based on FL- of body, starting from the tail), Hmax (Maximum Height), HH (Head Height), and T (Width or body thickness) (Fig. 1). Species were grouped using the statistical Ward's method, with Euclidian distances, based on the following ratios: SL/Hmax, SL/H33, SL/HT, T/H33, T/HH, T/Hmax, SL/T, SL/FL, SL/CH. The ratios were standardised amongst all species using SL as the common measurement. A second cluster analysis was similarly conducted by using 3 classes of thickness instead of a continuous variable for body thickness (T).

Length-weight relationships

In addition to the fish sampled for their morphology, data

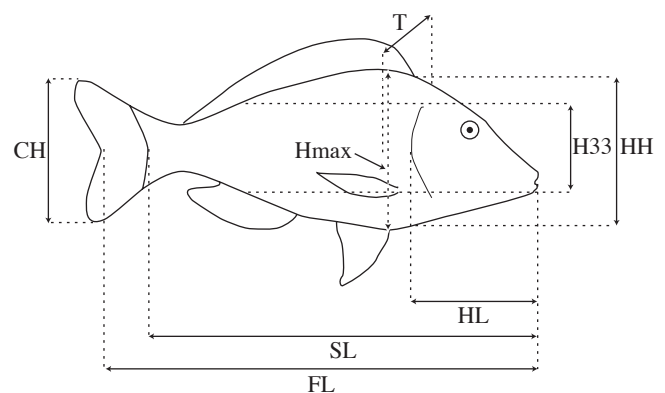


Figure 1. - Measurements performed on each fish. CH: Caudal fin Height; FL: Fork Length; SL: Standard Length; HL: Head Length; H33: Height at the first third (based on FL) of body (starting from the tail); Hmax: Maximum Height; HH: Head Height; T: Width or body thickness. [Mesures réalisées sur chaque poisson : CH : hauteur de la caudale ; FL : longueur à la fourche ; SL : longueur standard ; HL : longueur de la tête ; H33 : hauteur au premier tiers du corps (en partant de la queue) ; Hmax : hauteur maximale ; HH : hauteur de la tête ; T : épaisseur du corps.]

Table I. - Class limits for fish shapes. The class “oddly-shaped” regroups all species which do not fall within the other classes. [*Limites des classes pour les formes de poisson. La classe “odd” regroupe toutes les espèces qui ne tombent pas dans une des autres catégories.*]

Shape	SL/Hmax	T/Hmax
Very-flat	< 2.0	< 0.3
Compressed	2.0 - 3.0	0.3-0.45
Cylindrical	2.5 - 4.8	> 0.45
Semi-elongated	5.0 - 10.0	
Elongated	> 10.0	
Odd	Any other combination	

on a number of lagoon species were used to calculate length-weight relationships. The relationships were thus established from a total of 53,800 specimens, representing 788 species, 191 genera and 77 families. These data were collected between 1985 and 2003. All fishes were caught in the lagoon of New Caledonia, either by rotenone poisoning, spear-fishing, hand-line, gillnet, trawl nets, trammel nets or bottom long-line fishing.

Fork length was the measure used for all species in order to establish these relationships, except for rays, for which disk width is measured instead. The sexes are not differentiated here, although we are aware that males and females may have different length-weight relationships. The parameters a and b of relationships of the form $W = aL^b$ were estimated through a logarithmic transformation, i.e. $\ln W = \ln a + b \ln L$, with a and b estimated by ordinary least squares regression. L and W are respectively length in cm and weight in g.

The length-weight relationships were estimated according to taxonomic (species, genera, families) and morphological groupings (as defined above). The relationship for a given group was considered as valid when the measures from at least 8 specimens were available and when the significance level was at least of 0.01. In order to compare these relationships among groups, fish were classified (using a cluster analysis using the statistical Ward's method, with Euclidian distances, followed by an ANOVA) according to the ratios of SL/Hmax and T/Hmax into the following classes or shapes: elongated, semi-elongated, cylindrical, compressed, very-flat and oddly-shaped (Tab. I). Genera or families where several of these fish shapes were present were labelled “heterogeneous”.

Error estimates

Once the length-weight relationships were estimated the weight of each fish entering the estimate was back-calculated, yielding an estimated weight W_{est} . This value was compared to the true value W , allowing to have an estimation of the relative error E_{rel} :

$$E_{\text{rel}} = 100 [W - W_{\text{est}}] / \text{maximum}(W; W_{\text{est}})$$

For each species, genus, family or morphological group the E_{rel} were averaged, either for all the specimens or for only the largest ones (the fourth upper quartile) yielding respectively E_{aver} and $E_{75\%}$.

RESULTS

Species, genera and families

The results of length-weight analysis and grouping according to taxonomical criteria are presented in annexe 1. The identifications are essentially based on Rivaton *et al.* (1989), with recent updates in the literature being taken into account.

Relationships were not computed if there were less than 8 specimens. At the species level this allowed to estimate length-weight relationships for 444 species, but only 396 were kept. Relationships were rejected if they were not sufficiently significant ($p > 0.01$) or if the length interval for which weights were available was too narrow compared to the usual length of the species. At the genus level, all 191 genera had at least 9 specimens and only 6 relationships were rejected. At the family level, there were at least 11 specimens in each of the 77 families tested. Two families were rejected.

The error rates are given in table II. There is a slight but significant increase ($p < 0.05$) in the error rates from species to families. The average error on all specimens (E_{aver}) is higher than the error on the largest ones ($E_{75\%}$) (Tab. II), this difference being significant ($p < 0.05$) only at the species level. The error level was independent of body size within a species or morphological group, as there was no significant relationship between the level of error and the shape or size of the fish. At the genus level, genera with either odd shapes, elongated, compressed or very flat had higher relative errors than other shapes (Tab. III). At the family level the highest error levels were found in families with heterogeneous shapes, odd, elongated and semi-elongated shapes.

The coefficients of the length-weight relationship at the species level are function of the fish shape as indicated by figure 2A. An analysis of covariance indicates that the slopes and intercepts are different ($p < 0.05$) between each shape with the exception of “compressed” and “very flat” which are not significantly different. Similar results are found if one considers the genus or family levels.

One notices that the relationships between the coefficients a and b may be bounded by two lines (Fig. 2A). These two lines are only approximations, but may be defined by the following equations:

$$\text{Lower boundary: } \log(a) = -4.86b + 7.17$$

$$\text{Upper boundary: } \log(a) = -2.66b + 4.92$$

These lines could be physical or/and physiological lim-

Table II. - Distribution of the relative errors according to the taxonomic level or group. Confidence intervals are given for $p = 0.05$. E_{aver} : error based on average for all individuals, $E_{75\%}$: error based on average for the largest individual (last quartile). [Distribution des erreurs relatives en fonction du niveau taxinomique ou du groupe. Les intervalles de confiance sont donnés pour $p = 0.05$. E_{aver} : erreur basée sur la moyenne de tous les individus. $E_{75\%}$: erreur basée sur la moyenne des plus gros individus (dernier quartile).]

	Species	Genera	Families	Groups (I)
E_{aver}	9.4 ± 0.5	11.4 ± 1.0	13.5 ± 1.5	13.2 ± 1.4
$E_{75\%}$	8.1 ± 0.4	10.2 ± 0.9	13.8 ± 1.8	13.7 ± 2.0

Table III. - Average relative error at the genus and family levels for various fish shapes. "Heterogeneous" refers to genera or families represented by species with different shapes (e.g., Acanthuridae which have "compressed", "very-flat" species as well as "cylindrical" ones). [Erreur moyenne relative pour différentes formes de poissons au niveau du genre ou de la famille. "Hétérogène" se réfère aux genres ou familles représentés par plusieurs formes (par exemple les Acanthuridae englobent des espèces "comprimées", "très plates" aussi bien que "cylindriques").]

Shape	Nb genera	$E_{75\%}$ genera	E_{aver} genera	Nb families	$E_{75\%}$ families	E_{aver} families
Cylindrical	103	9.0	9.8	28	11.4	11.5
Compressed	35	9.4	10.1	12	9.6	9.4
Elongated	13	11.9	14.1	4	18.6	16.0
Semi-elongated	14	11.9	20.1	9	14.9	17.9
Very flat	8	13.4	12.8	4	12.0	10.5
Oddly shaped	10	19.4	17.0	5	25.9	20.4
Heterogeneous	4	9.6	10.5	13	16.5	16.0

its. To test this, it is possible to assimilate elongated fish as elongated cylinders with a density of 1. In that case if L is the length of the fish and T its thickness, then the weight W of the fish can be approximated by:

$$W = \pi T^2 L / 4$$

The most elongated species we observed (a Syngnathidae) had a ratio L/T of 36. This would result in an approximation of its weight by:

$$W = \pi L^3 / (4 \times 36^2), \text{ or } a = 0.0000596$$

If we use $b = 3$ in the equation of the lower boundary (Fig. 2A) we get an a of 0.0000654, which corresponds to an L/T ratio of 40 which could be a maximal limit.

If one considers the upper boundary one could assimilate a fish to a three dimensional volume with a length L , a height H and a thickness T . Assuming in a very simplistic manner that these dimensions are linearly related and the fish density equal to 1, we would get a crude approximation of the weight W by:

$$W = LHT/2$$

Replacing H and T by their relationship to L by respectively:

$$H = kL \text{ and } T = qL$$

$$\text{one would then get: } W = kqL^3/2$$

Looking at the value of a in the upper boundary equation

(Fig. 2A) for $b = 3$ one finds $a = 0.047$. This means that the value kq is lower than 0.1 if our crude hypothesis on general fish shape is respected. Interestingly, out of 298 values of kq only 14 were found over 0.1 and only one above 0.15.

Another way to consider the constraints on fish shapes is to analyse the variations of relative (using standard length as the reference) thickness and relative height (Fig. 2B). Fish belonging to the same shape are grouped, the separation between groups following a gradient according to the relative diameter of the species (from the most elongated to the most compact species). The overlap tends to increase as one goes towards the upper limits due to the log scaling. The values are again clearly bounded by an upper and a lower line, indicating that fish shapes are bounded by some physical limits.

Morphological groups

A first cluster analysis allowed to define 16 groups. Eight of these groups were either very large or not homogeneous, containing species with different shapes. In order to have homogeneous groups, a second cluster analysis was performed within each of these 8 heterogeneous groups resulting in a total of 30 groups (Group-I in Tab. IV). Differences in the ratios used to define the groups were tested by ANOVAs. All ratios were significantly different between groups (i.e. each ratio discriminated at least one group from the others). A MANOVA indicates that groups were statistically different from one another when considering all the ratios together. The most discriminating ratios were SL/H_{max} , T/H_{33} , T/HT , SL/T and the least discriminating ones were SL/FL , SL/CH . The length-weight relationships for the fish within each group were estimated from a total of 32,551 specimens of fish. The specifications of these relationships along with the characteristics of each group (Group-I) are given in table IV.

The error estimates for the groups are similar to those for families but larger than for genera or species (Tab. II). Errors within groups are always higher than for genera or species (Fig. 3). Compared to families, in the lower error ranges (less than 13% error), groups have larger errors on average, and on the opposite, past the 13% error rate groups yield lower estimates than families (Fig. 3).

To use this grouping to obtain the length-weight relationship for a new species supposes that one has access to at least one specimen in order to take the measurements as indicated on figure 1. As specimens are not necessarily available we propose an alternative method. There are pictures available for most species in Fishbase (Froese and Pauly, 2001) and FAO guides (Carpenter and Niem, 1998). From these pictures we can take all measurements of figure 1 except body thickness (T). This latter parameter may be estimated in 3 major classes: flat (or compressed), i.e. fish for which the

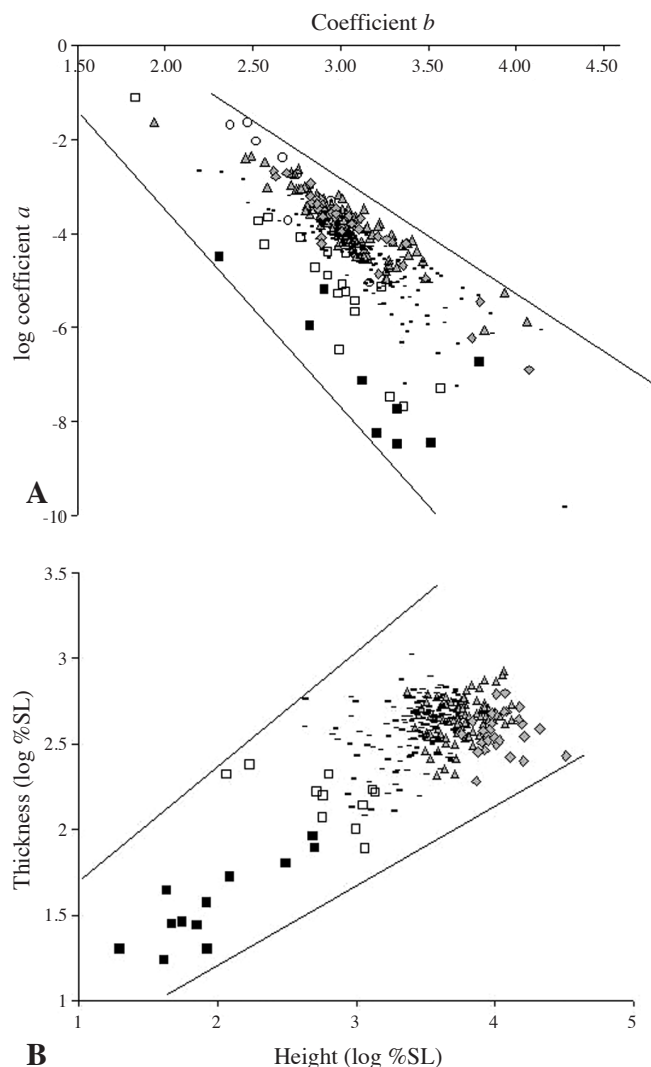


Figure 2. - **A**: Relationship between the regression coefficients a and b for various fish shapes at the species level. The upper and lower boundary lines are only approximate (see text). **B**: Relationship (on a log-log scale) between the relative (SL: standard length) thickness and relative height of fish for the various fish shapes at the species level. The upper and lower boundary lines are only approximate (see text). Δ Compressed, \blacksquare Elongated, \circ Cylindrical, \square Odd, \square Semi-elongated, \diamond Very-flat. [A : Relation au niveau spécifique entre les coefficients de régression a et b pour différentes formes de poisson. Les droites de limite supérieures et inférieures sont approximatives (voir texte). B : Relation (échelle log) entre l'épaisseur relative (SL: longueur standard) et la hauteur relative des poissons de différentes formes au niveau spécifique. Les droites limite supérieures et inférieures sont approximatives (voir texte). Δ Comprimé, \blacksquare Allongé, \circ Cylindrique, \square Divers, \square Semi-allongé, \diamond Très plat.]

ratio of body thickness to body height (T/Hmax) is less than 35%; normal fish for which this ratio is between 35 and 50%; round fish for which this ratio is above 50%. Using these 3 classes in table V as a proxy of body thickness will reduce the number of valid groups from 30 to 21 (Group-II), ANOVAs on the remaining ratios (SL/Hmax, SL/HH, SL/H33,

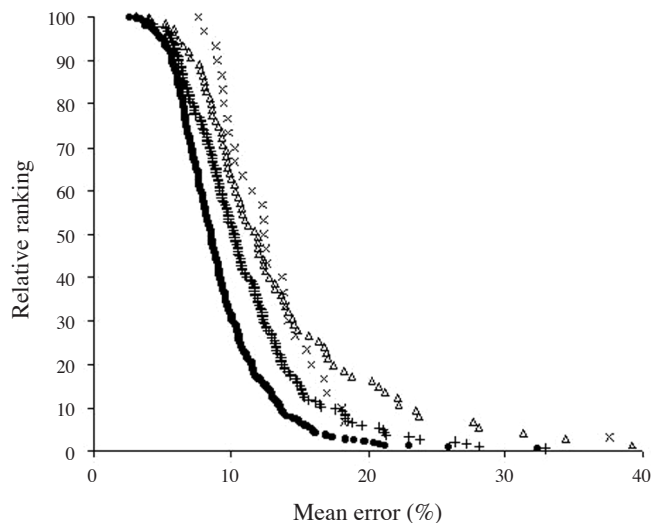


Figure 3. - Distribution of the mean error per species, genus, family or group. Errors are ranked from the lowest to the highest, the highest being given the relative rank 100 and the lowest the relative rank 1. \bullet Species, $+$ Genus, Δ Family, \times Group. [Distribution de l'erreur moyenne par espèce, genre, famille ou groupe. Les erreurs sont rangées de la plus petite à la plus grande, la plus grande se voyant attribuer le rang relatif 100 et la plus petite le rang relatif 1. \bullet Espèce, $+$ Genre, Δ Famille, \times Groupe.]

SL/FL, SL/CH) indicating that each group is significantly different from at least one other group. The error estimates for this new grouping is almost identical to the one for the grouping with 30 classes and is therefore not given on the graphs or tables.

DISCUSSION

Length-weight relationships are in great need for estimating the weight of fish for underwater visual censuses (UVC). UVCs are the most reliable and wide spread method to sample reef fish (e.g., English *et al.*, 1994; Cappo and Brown, 1996; Samoilys, 1997; Samoilys and Carlos, 2000; Labrosse *et al.*, 2001). Even so there are a number of problems linked to UVCs in particular estimating fish length accurately. Harvey *et al.* (2001, 2002) found that divers have a precision of approximately 10% on estimating fish lengths, which is much less accurate compared to stereo video camera systems which yield estimates within 1%. Several other studies have considered the precision of fish length estimates (see Kulbicki, 1998 for a review). Kulbicki (1997) found that this precision did not change much with the shape of the fish. On the opposite the precision is highly dependent on the training of the diver (Dalwall and Dulvy, 1996). These errors on length estimates may lead to a much higher error in weight. For instance, if one considers a 50 cm grouper, according to our equations (Annexe 1) its real weight would be 1,900 g, if underestimated at 45 cm its estimated weight would be 1,400 g, and over-

Table IV. - Groups defined from the analysis of the fish shapes. The notations used are similar to those from figure 1. The intervals are confidence limits with a probability level of 95%. N: number of species in group; n-LW: number of specimens used to estimate a and b. [Groupes définis à partir de l'analyse des formes de poisson. Les notations utilisées sont similaires à celles de la figure 1. Les intervalles sont les intervalles de confiance au niveau 95%. N : nombre d'espèces dans un groupe; n-LW : nombre de spécimens utilisés pour estimer a et b.]

Group-I	N	n-LW	r	a	b	SL/Hmax	SL/H33	SL/HH	SL/HL	SL/CH	T/H33	T/HH	T/Hmax	SL/T	Thickness	Group-II	r	a	b
27	23	2069	0.985	0.0412	2.8590	1.6 ± 0	2.4 ± 0.7	3 ± 0.4	3.3 ± 0.4	3.1 ± 0.5	0.33 ± 0.02	0.41 ± 0.02	0.22 ± 0.06	7.31 ± 1.17	flat	a	0.985	0.04128	2.8590
21	11	598	0.991	0.0406	2.8679	2.0 ± 0	3.6 ± 0.6	3 ± 0.4	3.5 ± 0.4	3.5 ± 0.9	0.64 ± 0.02	0.53 ± 0.03	0.35 ± 0.02	5.71 ± 0.49	flat	b	0.983	0.03984	2.8752
23	9	192	0.989	0.0235	3.1220	1.9 ± 0.1	2.8 ± 0.4	3.2 ± 0.2	3.4 ± 0.2	2.9 ± 0.5	0.5 ± 0.02	0.57 ± 0.01	0.34 ± 0.03	5.59 ± 0.44	flat	b			
26	24	1518	0.992	0.0340	2.9415	1.9 ± 0	3.3 ± 0.5	2.9 ± 0.3	3.5 ± 0.4	3.1 ± 0.7	0.51 ± 0.02	0.46 ± 0.01	0.29 ± 0.04	6.4 ± 0.48	flat	b			
25	11	1927	0.991	0.0199	3.0442	2.2 ± 0.1	3.4 ± 0.4	3.5 ± 0.3	3.9 ± 0.3	2.5 ± 0.3	0.44 ± 0.01	0.46 ± 0.01	0.28 ± 0.02	7.69 ± 0.8	flat	c	0.991	0.01990	3.0442
11	15	1009	0.996	0.0373	2.7496	2.2 ± 0.2	5.5 ± 1.4	3.1 ± 0.5	3.5 ± 0.5	3.9 ± 1.5	0.81 ± 0.04	0.46 ± 0.02	0.33 ± 0.04	6.72 ± 0.85	flat	d	0.993	0.04037	2.7227
24	5	381	0.966	0.0374	2.7630	2.3 ± 0.1	5.1 ± 0.4	3.1 ± 0.1	3.3 ± 0.4	3.3 ± 2.2	0.61 ± 0.05	0.37 ± 0.03	0.28 ± 0.04	8.41 ± 0.53	flat	d			
19	3	123	0.985	0.0253	2.9455	2.6 ± 0.2	4.2 ± 1	4.4 ± 0.6	4.8 ± 0.7	2.5 ± 0.5	0.52 ± 0.08	0.56 ± 0.06	0.33 ± 0.02	7.98 ± 0.92	flat	e	0.985	0.02538	2.9455
6	7	104	0.992	0.0197	3.0153	2.4 ± 0	4.6 ± 0.2	4 ± 0.3	4.2 ± 0.2	2.2 ± 0.3	0.72 ± 0.03	0.62 ± 0.05	0.38 ± 0.03	6.51 ± 0.27	normal	f	0.992	0.01976	3.0153
2	6	715	0.992	0.0178	3.1304	2.6 ± 0.1	3.7 ± 0.3	3.4 ± 0.2	3.1 ± 0.3	4.2 ± 1.9	0.63 ± 0.04	0.57 ± 0.02	0.44 ± 0.02	5.97 ± 0.35	normal	g			
20	16	4717	0.998	0.0250	2.9258	2.7 ± 0.1	4.3 ± 0.5	3.5 ± 0.4	3.4 ± 0.4	3.2 ± 1.1	0.58 ± 0.02	0.47 ± 0.01	0.37 ± 0.01	7.42 ± 0.75	normal	g	0.994	0.02855	2.8931
22	4	210	0.998	0.0214	3.0146	2.6 ± 0	3.2 ± 0.4	3.8 ± 0.6	3.3 ± 0.5	3.9 ± 0.8	0.49 ± 0.06	0.59 ± 0.06	0.4 ± 0.03	6.49 ± 0.53	normal	g			
4	17	5255	0.99	0.0149	3.0803	2.8 ± 0	4.8 ± 0.4	3.5 ± 0.2	3.2 ± 0.2	3.7 ± 2.6	0.71 ± 0.02	0.52 ± 0.01	0.41 ± 0.03	6.78 ± 0.55	normal	h	0.984	0.02066	2.9681
14	23	3518	0.995	0.0232	2.9163	2.8 ± 0.1	5.6 ± 0.5	3.5 ± 0.3	3.2 ± 0.4	3.7 ± 1	0.91 ± 0.03	0.56 ± 0.02	0.44 ± 0.04	6.26 ± 0.41	normal	h			
12	7	132	0.985	0.0089	3.4046	2.8 ± 0.2	7.2 ± 0.4	3.6 ± 0.3	3.5 ± 0.5	5.4 ± 3.7	1.04 ± 0.08	0.52 ± 0.03	0.41 ± 0.04	6.96 ± 0.36	normal	i	0.985	0.00892	3.4046
5	9	1151	0.996	0.0193	2.9695	3 ± 0.1	5.2 ± 0.4	3.9 ± 0.1	3.3 ± 0.2	3.8 ± 1.3	0.7 ± 0.03	0.53 ± 0.01	0.41 ± 0.03	7.43 ± 0.47	normal	j	0.996	0.01933	2.9695
13	7	354	0.986	0.0123	3.1365	3.2 ± 0.3	6.4 ± 0.6	4.5 ± 0.3	4 ± 0.5	3.6 ± 1	0.88 ± 0.02	0.62 ± 0.05	0.44 ± 0.04	7.29 ± 0.71	normal	k	0.986	0.01236	3.1365
8	3	150	0.969	0.0198	2.9042	3.2 ± 1.3	6.2 ± 0.4	5.4 ± 0.5	3.2 ± 0.1	5.7 ± 0.9	0.85 ± 0.09	0.71 ± 0.17	0.49 ± 0.08	7.08 ± 0.17	normal	l	0.969	0.01984	2.9042
3	16	851	0.987	0.0194	2.9790	3.4 ± 0.2	4.7 ± 0.5	4.3 ± 0.3	3.5 ± 0.3	4.5 ± 1.8	0.59 ± 0.03	0.53 ± 0.05	0.41 ± 0.08	7.91 ± 0.87	normal	m	0.987	0.01940	2.9790
1	13	543	0.989	0.0205	2.7353	4.5 ± 0.4	6.9 ± 0.9	6.1 ± 0.6	4.3 ± 0.3	6.3 ± 2.7	0.6 ± 0.06	0.53 ± 0.05	0.39 ± 0.06	11.7 ± 1.69	normal	n	0.989	0.02057	2.7353
30	10	82	0.958	0.0132	2.4060	> 10	> 10	> 10	7.2	> 10	1.08 ± 0.33	1.09 ± 0.38	0.75 ± 0.1	28.0 ± 3.67	round	o	0.958	0.01322	2.4060
28	1	342	0.982	0.00075	3.3577	13.2 ± 0	24.7 ± 0	13.5 ± 0	5.4 ± 0	7.6 ± 0	2.47 ± 0	1.35 ± 0	1.32 ± 0	10 ± 0	round	p	0.982	0.00075	3.3577
17	3	28	0.994	0.00733	3.5978	3.0 ± 0.8	4.2 ± 1.7	4.5 ± 1.3	2.9 ± 0.8	3.6 ± 0.3	1.05 ± 0.28	1.12 ± 0.03	0.78 ± 0.15	4.02 ± 1.32	round	q	0.994	0.00733	3.5978
9	5	204	0.994	0.0114	3.0936	3.3 ± 0.1	4.9 ± 0.4	3.7 ± 0.1	2.8 ± 0.3	3.7 ± 0.7	0.86 ± 0.03	0.67 ± 0.06	0.58 ± 0.02	5.7 ± 0.45	round	r	0.986	0.01921	2.9718
10	11	2542	0.993	0.0175	3.0023	3.1 ± 0.1	5 ± 0.4	3.8 ± 0.1	3.1 ± 0.2	3.5 ± 0.9	0.8 ± 0.03	0.61 ± 0.01	0.5 ± 0.01	6.21 ± 0.32	round	r			
7	11	939	0.997	0.0203	2.9194	3.8 ± 0.3	5.6 ± 0.6	4.9 ± 0.3	3.6 ± 0.6	3.1 ± 0.7	0.77 ± 0.05	0.68 ± 0.03	0.52 ± 0.04	7.28 ± 0.55	round	s	0.993	0.02183	2.8856
16	12	1181	0.995	0.0191	2.9174	3.9 ± 0.6	6.5 ± 1.3	4.7 ± 0.8	3.3 ± 0.6	4.9 ± 2.1	1.08 ± 0.04	0.78 ± 0.05	0.64 ± 0.09	6.02 ± 0.85	round	s			
15	8	585	0.987	0.00599	3.0064	6.8 ± 0.9	8 ± 1.2	9.3 ± 0.9	4.6 ± 0.7	5.6 ± 5.3	0.64 ± 0.06	0.74 ± 0.08	0.54 ± 0.05	12.9 ± 2.49	round	t	0.962	0.02109	2.6979
18	5	1096	0.989	0.00889	3.0250	6.4 ± 0.8	9.6 ± 1	7.9 ± 1.4	4.6 ± 0.4	6.7 ± 2.7	1.34 ± 0.1	1.1 ± 0.2	0.89 ± 0.07	7.16 ± 0.5	round	t			
29	3	35	0.992	0.0061	3.0818	7.4 ± 0.9	12.1 ± 1	9.9 ± 1.1	3.1 ± 0	7.3 ± 4.1	2.17 ± 0.27	1.78 ± 0.38	1.33 ± 0.12	5.58 ± 0.18	round	u	0.992	0.0061	3.0818

estimated at 55 cm it would yield 2,500 g. In other words, a 10% error estimate on length may generate an error on weight of approximately 25%. On top of this error linked to the length estimate there is the error linked to the choice in the length-weight relationship. The number of relationships available for reef fish species in the Pacific is rather limited. Before this work there were relationships for only 15.4% of the species (Fishbase: Froese and Pauly, 2001). We are adding relationships for a few more species (59 species in our list had no relationship available in Fishbase 2000), but what is new is that we provide relationships at higher taxonomic levels. Our data covers 92% of the 100 most speciose genera (amongst the 405 genera of shore fish in the tropical Pacific). In other words the data presented here allows to attribute length-weight relationships at the genus level for 75.6% of the reef species. At the family level, the coverage is nearly 85% and most of the missing families are usually not taken into account during UVC work (e.g., Carapidae, Ophichtidae, Tripterygiidae,...). Unfortunately the precision of the estimates from length-weight relationships at the family level and for some genera is not always satisfactory, in particular for those which have odd shapes or are elongated or semi-elongated or those which have heterogeneous shapes (Tab. III, Fig. 3). The group approach proposed in this article allows to close the gap in giving relationships which may be useful for either species for which no other relationship are available at present, or for species for which the existing relationships at either the genus or family level are not satisfactory. It may also provide a relationship when the observed fish is out of the length range for which the species, genus or family equation is provided for.

The present work by giving estimates of the relative error shows that: (i) the differences between species, genus, family and groups is on average small (less than 5% - Tab. II); (ii) there is much dispersion in these errors within an organisation level, the range being between 3 and 40% (Fig. 3) and (iii) the error level is linked to the shape of the fish (Tab. III). Looking at the very high values of the correlation coefficient (r) one tends to think that length-weight relationships yield excellent predictions. This is true if one considers the average of a large number of estimates, but our data shows that the dispersion of the estimates may be important in some cases and that it is not predictable from looking at r . A number of authors indicate that length-weight relationships vary with regions (see Écoutin and Albaret, 2002) or with season or year (e.g., Cucalon-Zenck, 1999; Anibeze, 2000). We have not investigated this matter, even though we have enough material to do so, but the level of difference found by most authors suggest that for UVC purposes these differences would remain minor compared to the error made on length estimates by divers. There are also differences accord-

ing to sexes, but sex is very seldom taken into account during UVC work and the differences due to sex are much lower than those from other sources.

A number of length-weight relationships are available in the literature. Unfortunately for some of them, there are either errors or the types of measure are not indicated (e.g. fork length, standard length or total length). Figure 2A is a convenient way to check that the values available fall within an acceptable range. More interesting, the upper and lower boundaries on the values of the relationship between the coefficients a and b appear to be some physical limits to the dimensions of fish as suggested by our crude approach (Fig. 2B) on general fish shapes (see Pauly (1997), for a discussion on such physical limits). More refined modelling on these limits with more realistic equations of fish volumes could represent a path in understanding some of the physical constraints on fish shapes and connected capacities such as speed or energy consumption (see O'Dor and Hoar (2000) for a comparison between squids and fish; and Blier *et al.* (1997) for a discussion on fish capacities in this domain), which are useful in bounding some estimates in ecological modelling such as ECOPATH (Christensen and Walters, 2004).

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ANNEXE 1

Species are arranged by families in alphabetical order; species and genera within each family are presented alphabetically. For each family, each genus and each taxa, the estimation of parameters *a* and *b*, the number of specimens used (*N*), the correlation coefficient (*r*), maximum and minimum length (cm), and % of error are given. Name: if no name given, all specimens within the family were considered; "spp." after the genus name indicates that all specimens within the genus were considered. [Les espèces sont rangées par ordre alphabétique au sein des familles et genres, les familles étant elles-mêmes ordonnées alphabétiquement. Pour chaque famille, genre et taxon les estimations des paramètres *a* et *b*, le nombre de spécimens utilisés (*N*), le coefficient de corrélation (*r*), les longueurs maximum et minimum (cm) et le % d'erreur sont donnés. Nom: si aucun nom n'est donné, tous les spécimens au sein d'une famille sont considérés; "spp." après le nom de genre indique que tous les spécimens au sein du genre sont considérés.]

Family	Name	Shape	N	r	L.min	L.max	a	b	%error
Acanthuridae		heterogeneous	1141	0.995	2.0	60.0	0.0301	2.946	13.3
	<i>Acanthurus</i> spp.	compressed	639	0.996	2.5	57.0	0.0280	2.983	10.2
	<i>Acanthurus blochii</i>	compressed	249	0.996	2.5	38.0	0.0251	3.032	9.8
	<i>Acanthurus dussumieri</i>	compressed	95	0.993	2.5	51.5	0.0426	2.868	10.7
	<i>Acanthurus nigricauda</i>	compressed	51	0.995	4.6	22.5	0.0168	3.168	8.8
	<i>Acanthurus mata</i>	compressed	48	0.990	10.0	29.5	0.0222	3.008	6.9
	<i>Acanthurus nigrofuscus</i>	compressed	124	0.990	4.5	18.7	0.0264	3.028	8.7
	<i>Acanthurus triostegus</i>	compressed	22	0.972	6.5	16.5	0.0831	2.570	9.1
	<i>Acanthurus xanthopterus</i>	compressed	35	0.999	8.0	57.0	0.0267	2.984	5.9
	<i>Ctenochaetus</i> spp.	compressed	198	0.994	3.8	21.0	0.0237	3.056	6.5
	<i>Ctenochaetus binotatus</i>	compressed	18	0.969	8.5	15.3	0.0392	2.875	9.3
	<i>Ctenochaetus striatus</i>	compressed	180	0.995	3.8	21.0	0.0231	3.063	7.7
	<i>Naso</i> spp.	heterogeneous	123	0.996	2.0	60.0	0.0085	3.250	15.1
	<i>Naso annulatus</i>	compressed	9	0.989	28.0	42.0	0.0510	2.715	3.6
	<i>Naso brevirostris</i>	cylindrical	27	0.991	2.0	33.0	0.0107	3.243	32.3
	<i>Naso hexacanthus</i>	compressed	9	0.996	18.5	46.0	0.0202	2.956	6.6
	<i>Naso unicornis</i>	compressed	66	0.989	18.5	60.0	0.0179	3.035	6.8
	<i>Zebrasoma</i> spp.	very-flat	181	0.991	4.0	26.5	0.0378	2.857	14.4
	<i>Zebrasoma scopas</i>	very-flat	104	0.989	4.0	16.0	0.0291	2.993	9.1
	<i>Zebrasoma veliferum</i>	very-flat	77	0.995	4.0	24.0	0.0343	2.866	8.0
Albulidae	<i>Albula</i> spp.	cylindrical	31	0.995	35.5	78.0	0.0205	2.869	7.7
Antennariidae	<i>Antennarius</i> spp.	odd	17	0.982	4.0	11.0	0.0236	3.293	9.5
Apogonidae		heterogeneous	1873	0.970	2.0	18.5	0.0143	3.143	17.2
	<i>Apogon</i> spp.	cylindrical	1381	0.975	2.0	16.0	0.0155	3.121	17.3
	<i>Apogon angustatus</i>	cylindrical	59	0.938	2.6	9.0	0.0049	3.780	15.6
	<i>Apogon aureus</i>	cylindrical	116	0.980	6.2	12.0	0.0064	3.509	8.4
	<i>Apogon bandanensis</i>	cylindrical	72	0.959	3.5	10.0	0.0140	3.250	12.9
	<i>Apogon catalai</i>	compressed	9	0.962	5.0	7.0	0.0052	3.935	8.8
	<i>Apogon compressus</i>	cylindrical	13	0.941	6.0	10.4	0.0186	2.984	10.1
	<i>Apogon cookii</i>	cylindrical	15	0.950	4.8	7.0	0.0058	3.689	11.3
	<i>Apogon cyanosoma</i>	cylindrical	42	0.873	4.0	6.9	0.0074	3.563	16.9
	<i>Apogon doderleini</i>	cylindrical	74	0.963	3.5	9.4	0.0090	3.460	15.0
	<i>Apogon ellioti</i>	cylindrical	23	0.975	5.5	13.0	0.0172	2.991	9.8
	<i>Apogon exostigma</i>	cylindrical	62	0.972	4.0	10.3	0.0164	3.069	14.0
	<i>Apogon fraenatus</i>	cylindrical	218	0.982	3.5	11.0	0.0130	3.165	9.2
	<i>Apogon fuscus</i>	cylindrical	53	0.981	4.0	15.0	0.0407	2.699	9.4
	<i>Apogon hyalosoma</i>	cylindrical	42	0.983	6.0	15.0	0.0071	3.449	8.6
	<i>Apogon kallopterus</i>	cylindrical	66	0.980	4.5	12.0	0.0101	3.314	9.2
	<i>Apogon lateralis</i>	cylindrical	106	0.970	3.5	8.5	0.0184	3.051	15.2
	<i>Apogon lineolatus</i>	cylindrical	11	0.901	6.0	7.5	0.0045	3.683	10.7
	<i>Apogon nigrofasciatus</i>	cylindrical	28	0.973	3.5	8.0	0.0086	3.510	10.9
	<i>Apogon norfolcensis</i>	cylindrical	74	0.942	5.8	12.0	0.0102	3.277	10.0
	<i>Apogon novemfasciatus</i>	cylindrical	17	0.971	3.0	9.5	0.0086	3.414	11.6
Apogonidae	<i>Apogon trimaculatus</i>	cylindrical	55	0.977	2.0	16.0	0.0217	2.971	12.7
	<i>Archamia</i> spp.	cylindrical	105	0.924	5.2	8.5	0.0084	3.395	10.3
	<i>Archamia fucata</i>	compressed	49	0.954	5.2	8.5	0.0089	3.323	9.6

Family	Name	Shape	N	r	L.min	L.max	a	b	%error
Apogonidae	<i>Archamia leai</i>	compressed	17	0.957	5.2	8.2	0.0072	3.480	9.2
	<i>Archamia lineolata</i>	compressed	16	0.924	6.0	8.0	0.0485	2.586	7.1
	<i>Cheilodipterus</i> spp.	cylindrical	282	0.978	3.0	18.5	0.0132	3.085	8.1
	<i>Cheilodipterus artus</i>	cylindrical	21	0.976	4.7	14.4	0.0038	3.590	14.6
	<i>Cheilodipterus lachneri</i>	cylindrical	51	0.963	6.0	12.5	0.0022	3.858	8.6
	<i>Cheilodipterus macrodon</i>	cylindrical	16	0.996	8.0	18.5	0.0054	3.433	6.6
	<i>Cheilodipterus quinquelineatus</i>	cylindrical	194	0.974	3.0	11.0	0.0161	2.999	11.6
	<i>Fowleria</i> spp.	cylindrical	70	0.938	3.0	8.2	0.0082	3.567	17.3
	<i>Fowleria aurita</i>	cylindrical	12	0.997	4.1	8.2	0.0376	2.776	4.3
	<i>Fowleria marmorata</i>	cylindrical	13	0.959	4.0	7.5	0.0024	4.136	17.4
	<i>Fowleria variegata</i>	cylindrical	35	0.960	3.0	8.0	0.0134	3.350	19.7
Atherinidae	<i>Atherinomorus lacunosus</i>	cylindrical	49	0.968	6.5	13.0	0.0064	3.298	9.7
Aulostomidae	<i>Aulostomus chinensis</i>	elongated	11	0.989	31.8	68.0	0.0002	3.514	9.8
Balistidae		heterogeneous	595	0.994	5.0	61.0	0.0057	3.393	18.3
	<i>Abalistes stellaris</i>	compressed	111	0.991	14.0	53.5	0.0472	2.760	5.7
	<i>Balistoides</i> spp.	compressed	12	0.994	27.4	61.0	0.0190	3.078	6.6
	<i>Balistoides viridescens</i>	compressed	10	0.998	27.4	61.0	0.0244	3.018	3.9
	<i>Pseudobalistes fuscus</i>	compressed	76	0.989	16.3	58.0	0.0726	2.760	6.2
	<i>Sufflamen</i> spp.	compressed	122	0.982	16.6	36.5	0.0324	2.929	6.0
	<i>Sufflamen fraenatus</i>	compressed	118	0.980	18.5	36.5	0.0287	2.966	6.5
Belonidae		semi-elongated	81	0.974	16.5	88.0	0.0008	3.203	10.6
	<i>Strongylura</i> spp.	semi-elongated	51	0.957	29.0	75.0	0.0011	3.101	10.3
	<i>Strongylura incisa</i>	semi-elongated	11	0.950	36.5	72.5	0.0016	2.996	11.8
	<i>Strongylura urvilli</i>	semi-elongated	23	0.991	29.0	73.5	0.0005	3.361	8.4
Blenniidae	<i>Tylosurus crocodilus</i>	semi-elongated	29	0.985	29.5	88.0	0.0006	3.285	10.1
		heterogeneous	246	0.860	3.5	16.6	0.0022	3.901	29.9
	<i>Atrosalarias fuscus</i>	cylindrical	50	0.926	3.6	10.2	0.0149	3.018	16.2
	<i>Cirripectes</i> spp.	cylindrical	41	0.981	5.5	10.0	0.0130	3.150	7.8
	<i>Cirripectes chelomatus</i>	cylindrical	19	0.949	7.0	10.0	0.0147	3.099	7.3
	<i>Cirripectes stigmaticus</i>	cylindrical	17	0.989	5.5	9.0	0.0183	2.969	5.7
	<i>Ecsenius</i> spp.	cylindrical	49	0.939	4.0	9.5	0.0239	2.584	7.5
	<i>Ecsenius bicolor</i>	cylindrical	46	0.930	4.0	9.5	0.0239	2.583	10.6
	<i>Meiacanthus</i> spp.	semi-elongated	9	0.866	4.5	6.0	0.0009	4.470	13.7
	<i>Petroscirtes</i> spp.	semi-elongated	15	0.885	3.5	10.5	0.0097	3.016	29.7
	<i>Plagiotremus</i> spp.	elongated	33	0.854	5.0	9.5	0.0018	3.581	22.8
	<i>Plagiotremus rhinorhynchus</i>	elongated	20	0.913	6.0	9.5	0.0012	3.792	13.9
	<i>Plagiotremus tapeinosoma</i>	elongated	10	0.921	5.5	9.0	0.0057	2.908	15.9
	<i>Salarias fasciatus</i>	cylindrical	25	0.922	4.0	11.0	0.0138	2.980	13.6
Bothidae		very-flat	260	0.962	5.5	20.5	0.0072	3.213	13.4
	<i>Arnoglossus</i> spp.	very-flat	32	0.894	6.0	11.5	0.0002	4.811	27.2
	<i>Asterorhombus intermedius</i>	very-flat	59	0.914	7.0	12.5	0.0010	4.075	15.7
	<i>Bothus pantherinus</i>	very-flat	21	0.963	8.0	18.0	0.0020	3.751	18.3
	<i>Engyprosopon grandisquama</i>	very-flat	108	0.979	5.5	12.0	0.0168	2.894	7.1
	<i>Grammatobothus polyophthalmus</i>	very-flat	39	0.969	11.0	20.5	0.0148	2.895	6.8
Bythitidae	<i>Dinematichthys</i> spp.	elongated	55	0.869	4.0	10.2	0.0072	3.155	18.0
Caesionidae		cylindrical	377	0.986	6.0	24.3	0.0085	3.278	5.3
	<i>Caesio</i> spp.	cylindrical	195	0.986	6.7	24.3	0.0093	3.253	7.1
	<i>Caesio caeruleaurea</i>	cylindrical	90	0.996	6.7	21.4	0.0200	2.991	6.1
	<i>Caesio cuning</i>	cylindrical	9	0.989	19.5	24.3	0.0149	3.121	2.6
	<i>Pterocaesio</i> spp.	cylindrical	182	0.988	6.0	15.5	0.0092	3.234	5.2
	<i>Pterocaesio diagramma</i>	cylindrical	82	0.991	8.0	15.5	0.0069	3.341	5.2
	<i>Pterocaesio trilineata</i>	cylindrical	94	0.987	6.0	15.0	0.0107	3.178	6.8
Callionymidae		cylindrical	35	0.972	3.5	16.0	0.0329	2.466	15.1
	<i>Synchiropus</i> spp.	cylindrical	25	0.989	3.5	16.0	0.0491	2.317	12.2
	<i>Synchiropus rameus</i>	cylindrical	13	0.930	10.0	16.0	0.0687	2.184	9.4

Family	Name	Shape	N	r	L.min	L.max	a	b	%error
Callionymidae	<i>Synchiropus splendidus</i>	cylindrical	12	0.935	3.5	6.0	0.0109	3.341	14.8
Carangidae		heterogeneous	988	0.984	3.3	93.0	0.0083	3.197	17.9
	<i>Atule mate</i>	cylindrical	62	0.985	10.0	27.7	0.0166	2.949	11.1
	<i>Carangoides</i> spp.	compressed	352	0.994	8.5	86.0	0.0361	2.812	9.4
	<i>Carangoides armatus</i>	compressed	12	0.990	32.0	51.0	0.0115	3.126	4.9
	<i>Carangoides chrysophrys</i>	compressed	130	0.997	12.5	60.0	0.0267	2.902	7.5
	<i>Carangoides ferdau</i>	compressed	31	0.990	24.5	60.5	0.0368	2.851	6.6
	<i>Carangoides fulvoguttatus</i>	compressed	54	0.993	16.0	81.0	0.0329	2.808	8.8
	<i>Carangoides gymnotethus</i>	compressed	23	0.999	8.5	86.0	0.0463	2.746	5.6
	<i>Carangoides hedlandensis</i>	compressed	16	0.996	9.5	32.0	0.0381	2.864	6.0
	<i>Carangoides orthogrammus</i>	compressed	34	0.994	28.0	62.0	0.0156	3.026	6.3
	<i>Carangoides uii</i>	compressed	19	0.994	12.0	30.5	0.0321	2.902	7.7
	<i>Caranx</i> spp.	compressed	267	0.998	5.5	93.0	0.0198	2.986	13.9
	<i>Caranx ignobilis</i>	compressed	94	0.998	7.0	93.0	0.0164	3.059	8.1
	<i>Caranx melampygus</i>	compressed	25	0.999	5.5	54.0	0.0234	2.918	6.9
	<i>Caranx papuensis</i>	compressed	135	0.997	6.5	65.0	0.0235	2.923	10.2
	<i>Decapterus russellii</i>	cylindrical	17	0.993	11.5	30.0	0.0139	2.963	6.9
	<i>Gnathanodon speciosus</i>	compressed	20	0.999	4.0	74.5	0.0199	2.995	10.9
	<i>Pseudocaranx dentex</i>	compressed	11	0.998	27.0	59.0	0.0271	2.886	3.1
	<i>Scomberoides lysan</i>	cylindrical	14	0.995	11.5	55.5	0.0109	2.923	6.2
	<i>Scomberoides tol</i>	cylindrical	189	0.993	3.3	37.0	0.0154	2.787	9.6
	<i>Selar crumenophthalmus</i>	cylindrical	34	0.966	18.0	27.5	0.0097	3.194	6.0
Carcharhinidae		cylindrical	159	0.949	45.1	120.0	0.0010	3.566	15.9
	<i>Carcharhinus</i> spp.	cylindrical	131	0.970	45.1	120.0	0.0013	3.508	9.3
	<i>Carcharhinus albimarginatus</i>	cylindrical	10	0.921	61.0	76.0	0.0001	4.268	7.3
	<i>Carcharhinus amblyrhynchos</i>	cylindrical	54	0.951	45.1	120.0	0.0023	3.373	9.3
	<i>Carcharhinus limbatus</i>	cylindrical	26	0.977	47.5	86.0	0.0033	3.283	7.7
	<i>Carcharhinus sorrah</i>	cylindrical	27	0.982	52.0	91.0	0.0007	3.656	6.6
Centropomidae	<i>Ambassis interruptus</i>	cylindrical	12	0.899	5.5	7.5	0.0079	3.543	12.4
Chaetodontidae		very-flat	2097	0.983	2.0	23.5	0.0421	2.847	12.9
	<i>Chaetodon</i> spp.	very-flat	1927	0.982	2.0	19.0	0.0450	2.814	11.7
	<i>Chaetodon auriga</i>	very-flat	246	0.992	2.4	19.0	0.0404	2.829	10.3
	<i>Chaetodon bennetti</i>	very-flat	20	0.994	3.0	12.6	0.0384	2.885	7.9
	<i>Chaetodon citrinellus</i>	very-flat	74	0.986	3.0	10.5	0.0353	2.834	9.6
	<i>Chaetodon ephippium</i>	very-flat	63	0.995	3.4	17.5	0.0225	3.061	6.7
	<i>Chaetodon flavirostris</i>	very-flat	174	0.994	2.6	16.5	0.0251	3.113	8.4
	<i>Chaetodon lineolatus</i>	very-flat	89	0.987	2.0	20.0	0.0693	2.622	13.3
	<i>Chaetodon melanotus</i>	very-flat	138	0.988	2.0	11.1	0.0267	3.049	9.9
	<i>Chaetodon mertensii</i>	very-flat	15	0.983	7.0	10.0	0.0043	3.793	5.4
	<i>Chaetodon pelewensis</i>	very-flat	26	0.967	5.0	9.0	0.0153	3.297	11.2
	<i>Chaetodon plebeius</i>	very-flat	283	0.980	2.0	10.0	0.0606	2.628	9.0
	<i>Chaetodon speculum</i>	very-flat	444	0.984	2.0	11.5	0.0664	2.693	8.9
	<i>Chaetodon trifascialis</i>	very-flat	23	0.985	3.0	14.0	0.0258	2.969	10.2
	<i>Chaetodon trifasciatus</i>	very-flat	189	0.983	3.5	12.1	0.0311	2.976	8.0
	<i>Chaetodon ulietensis</i>	very-flat	36	0.995	3.3	12.1	0.0311	2.874	6.9
	<i>Chaetodon unimaculatus</i>	very-flat	13	0.998	4.5	18.0	0.0533	2.833	5.2
	<i>Chaetodon vagabundus</i>	very-flat	65	0.990	4.0	14.0	0.0278	2.973	6.4
	<i>Heniochus</i> spp.	very-flat	146	0.991	3.5	21.4	0.0252	3.082	11.2
	<i>Heniochus acuminatus</i>	very-flat	85	0.990	3.5	17.5	0.0247	3.106	11.6
	<i>Heniochus chrysostomus</i>	very-flat	24	0.981	5.0	14.0	0.0161	3.262	12.8
	<i>Heniochus monoceros</i>	very-flat	29	0.991	9.0	21.0	0.0170	3.211	9.1
Chanidae	<i>Chanos chanos</i>	cylindrical	85	0.978	14.5	35.0	0.0047	3.389	9.1
Chirocentridae	<i>Chirocentrus dorab</i>	semi-elongated	30	0.926	32.5	63.0	0.0051	2.987	10.5
Cirrhitidae		cylindrical	22	0.985	4.3	15.0	0.0093	3.268	8.0
	<i>Cirrhitichthys falco</i>	cylindrical	17	0.939	4.3	8.0	0.0033	3.849	12.6

Family	Name	Shape	N	r	L.min	L.max	a	b	%error
Clinidae		semi-elongated	34	0.893	3.5	8.9	0.0021	3.855	9.0
	<i>Heteroclinus roseus</i>	semi-elongated	10	0.914	3.5	8.0	0.0168	2.775	76.3
Clupeidae		cylindrical	896	0.987	3.5	24.0	0.0093	3.314	19.8
	<i>Anodontostoma chacunda</i>	cylindrical	691	0.994	3.5	24.0	0.0202	3.049	7.4
	<i>Herklotsichthys quadrimaculatus</i>	cylindrical	70	0.946	5.0	14.5	0.0065	3.317	9.2
	<i>Sardinella fijiensis</i>	cylindrical	36	0.992	5.5	15.5	0.0163	2.971	9.4
Congridae		elongated	14	0.999	10.9	110.0	0.0008	3.127	9.7
	<i>Conger cinereus</i>	elongated	14	0.989	56.0	106.0	0.0026	2.824	6.5
Dasyatidae		very-flat	82	0.990	17.0	49.5	0.0094	3.352	16.0
	<i>Dasyatis</i> spp.	very-flat	82	0.990	17.0	49.5	0.0094	3.352	16.0
	<i>Dasyatis kuhlii</i>	very-flat	78	0.992	17.0	49.5	0.0092	3.357	7.9
Diodontidae		odd	25	0.969	1.0	75.0	0.0678	2.784	37.6
	<i>Diodon</i> spp.	odd	22	0.982	28.0	75.0	0.1934	2.472	9.5
	<i>Diodon hystrix</i>	odd	22	0.982	28.0	75.0	0.1934	2.472	9.5
Echeneidae	<i>Echeneis naucrates</i>	cylindrical	342	0.982	12.0	84.5	0.0008	3.358	9.4
Eleotrididae	<i>Butis amboinensis</i>	cylindrical	14	0.919	4.5	8.5	0.0075	3.029	15.3
Elopidae	<i>Elops machnata</i>	semi-elongated	68	0.953	18.5	85.0	0.0125	2.927	21.2
Engraulidae		cylindrical	96	0.961	5.0	12.5	0.0034	3.492	14.3
	<i>Stolephorus</i> spp.	cylindrical	11	0.829	8.5	12.5	0.0252	2.600	13.8
	<i>Thryssina baelama</i>	cylindrical	85	0.966	5.0	11.5	0.0028	3.586	10.6
Ephippidae	<i>Platax</i> spp.	very-flat	11	0.999	4.5	50.0	0.0443	2.951	12.4
Fistulariidae		elongated	47	0.976	18.5	44.0	0.0005	3.048	10.1
	<i>Fistularia</i> spp.	elongated	43	0.993	19.0	44.0	0.0003	3.205	5.7
	<i>Fistularia petimba</i>	elongated	43	0.993	19.0	44.0	0.0003	3.205	5.7
Gerreidae		compressed	1590	0.989	3.0	34.0	0.0194	3.070	9.0
	<i>Gerres</i> spp.	compressed	273	0.995	5.0	21.5	0.0240	3.011	8.6
	<i>Gerres filamentosus</i>	compressed	963	0.992	3.0	19.0	0.0229	3.005	8.1
	<i>Gerres ovatus</i>	compressed	963	0.992	3.0	19.0	0.0229	3.005	8.1
	<i>Gerres oyena</i>	cylindrical	339	0.979	4.0	20.0	0.0095	3.337	12.8
Gobiidae		cylindrical	296	0.951	2.3	36.5	0.0264	2.623	24.0
	<i>Amblygobius phalaena</i>	cylindrical	57	0.958	3.0	11.7	0.0184	2.834	13.6
	<i>Exyrias</i> spp.	cylindrical	28	0.984	4.5	13.5	0.0120	2.921	12.7
	<i>Exyrias bellissimus</i>	cylindrical	23	0.969	7.0	13.5	0.0130	2.882	8.8
	<i>Gnatholepis</i> spp.	cylindrical	13	0.925	3.5	8.5	0.0175	2.827	9.7
	<i>Gobiodon citrinus</i>	cylindrical	12	0.932	2.8	5.2	0.0577	2.439	11.4
	<i>Istigobius</i> spp.	cylindrical	51	0.961	3.0	11.0	0.0183	2.782	9.9
	<i>Istigobius decoratus</i>	cylindrical	24	0.978	5.5	11.0	0.0180	2.777	8.9
	<i>Istigobius ornatus</i>	cylindrical	14	0.949	3.8	9.0	0.0098	3.108	20.5
	<i>Oxyurichthys</i> spp.	cylindrical	23	0.949	7.0	14.5	0.0134	2.903	13.9
	<i>Oxyurichthys papuensis</i>	cylindrical	12	0.968	8.0	14.0	0.0126	2.910	10.4
	<i>Prionolepis cinctus</i>	cylindrical	13	0.951	3.5	7.0	0.0153	3.008	11.6
	<i>Valenciennesia</i> spp.	cylindrical	17	0.989	4.5	12.5	0.0104	2.859	4.5
	<i>Valenciennesia longipinnis</i>	cylindrical	9	0.980	7.5	12.5	0.0054	3.136	6.5
Grammistidae		heterogeneous	22	0.987	1.0	27.0	0.0124	3.234	30.8
	<i>Diploprion bifasciatum</i>	compressed	16	0.942	13.4	20.0	0.0089	3.278	10.1
Haemulidae		heterogeneous	1530	0.997	4.0	75.0	0.0217	2.898	10.5
	<i>Diagramma pictus</i>	compressed	547	0.997	7.0	75.0	0.0144	2.988	5.8
	<i>Plectorhinchus</i> spp.	compressed	106	0.988	7.0	55.5	0.0197	2.969	9.2
	<i>Plectorhinchus chaetodonoides</i>	compressed	17	0.998	14.0	53.5	0.0173	3.040	6.1
	<i>Plectorhinchus gibbosus</i>	compressed	14	0.975	7.0	38.0	0.0226	2.962	13.8
	<i>Plectorhinchus lineatus</i>	cylindrical	22	0.994	19.5	44.0	0.0126	3.079	4.8
	<i>Plectorhinchus obscurus</i>	compressed	27	0.995	17.5	55.5	0.0270	2.885	6.9
	<i>Plectorhinchus picus</i>	compressed	16	0.990	36.0	54.5	0.0115	3.089	3.8
	<i>Pomadasys argenteus</i>	cylindrical	875	0.997	4.0	43.0	0.0188	2.954	6.6
Hemigaleidae	<i>Triaenodon obesus</i>	cylindrical	20	0.971	52.0	108.0	0.0018	3.344	10.7
Hemiramphidae		semi-elongated	92	0.896	13.0	44.5	0.0000	4.920	35.4
	<i>Hemiramphus affinis</i>	semi-elongated	12	0.985	13.5	27.5	0.0007	3.575	13.3
	<i>Hemiramphus far</i>	semi-elongated	69	0.921	22.0	44.5	0.3298	1.831	9.0

Family	Name	Shape	N	r	L.min	L.max	a	b	%error
Holocentridae		heterogeneous	1533	0.988	2.9	31.5	0.0222	3.059	11.1
	<i>Myripristis</i> spp.	cylindrical	504	0.990	3.5	22.5	0.0276	3.030	8.7
	<i>Myripristis amaena</i>	cylindrical	22	0.995	5.0	17.0	0.0158	3.261	5.1
	<i>Myripristis berndti</i>	cylindrical	87	0.994	4.5	22.5	0.0277	3.003	8.2
	<i>Myripristis hexagona</i>	cylindrical	16	0.997	4.6	19.0	0.0250	3.089	7.9
	<i>Myripristis kuntee</i>	cylindrical	81	0.953	6.0	14.0	0.0099	3.468	13.5
	<i>Myripristis melanosticta</i>	cylindrical	61	0.993	4.0	19.5	0.0292	3.024	9.8
	<i>Myripristis pralinia</i>	cylindrical	41	0.996	5.0	15.0	0.0227	3.095	5.8
	<i>Myripristis violacea</i>	cylindrical	138	0.991	3.5	19.2	0.0364	2.940	8.4
	<i>Neoniphon</i> spp.	cylindrical	196	0.995	3.5	19.0	0.0288	2.867	8.7
	<i>Neoniphon argenteus</i>	cylindrical	57	0.993	4.5	18.2	0.0317	2.823	7.0
	<i>Neoniphon sammara</i>	cylindrical	138	0.995	3.5	19.0	0.0276	2.888	7.3
	<i>Plectrypops lima</i>	cylindrical	11	0.963	5.5	10.5	0.0177	3.139	11.7
	<i>Sargocentron</i> spp.	cylindrical	822	0.993	2.9	31.5	0.0219	3.047	8.7
	<i>Sargocentron diadema</i>	cylindrical	322	0.989	5.0	15.0	0.0251	2.955	8.3
	<i>Sargocentron rubrum</i>	cylindrical	371	0.993	2.9	23.0	0.0275	2.998	7.4
	<i>Sargocentron spiniferum</i>	compressed	122	0.975	11.5	31.5	0.0154	3.119	9.0
Kuhliidae	<i>Kuhlia</i> spp.	cylindrical	36	0.997	4.0	24.0	0.0160	3.034	5.0
	<i>Kuhlia marginata</i>	cylindrical	31	0.996	4.0	17.5	0.0146	3.083	7.8
Kyphosidae	<i>Kyphosus</i> spp.	compressed	22	0.987	17.7	53.5	0.0129	3.151	5.1
	<i>Kyphosus vaigiensis</i>	compressed	12	0.997	17.7	48.0	0.0200	3.037	6.1
Labridae		heterogeneous	1382	0.995	2.5	93.0	0.0107	3.178	15.9
	<i>Anampses</i> spp.	cylindrical	13	0.980	4.5	13.6	0.0226	2.793	10.6
	<i>Bodianus</i> spp.	cylindrical	510	0.994	8.0	59.0	0.0108	3.173	5.5
	<i>Bodianus perditio</i>	cylindrical	496	0.991	16.5	59.0	0.0119	3.149	5.9
	<i>Cheilinus</i> spp.	cylindrical	111	0.996	4.2	93.0	0.0155	3.058	15.5
	<i>Cheilinus bimaculatus</i>	cylindrical	28	0.967	5.0	13.0	0.0679	2.317	10.9
	<i>Cheilinus chlorourus</i>	compressed	44	0.994	4.2	32.0	0.0197	2.993	11.7
	<i>Cheilinus trilobatus</i>	compressed	9	0.997	8.5	24.0	0.0162	3.059	8.5
	<i>Cheilinus undulatus</i>	compressed	16	0.998	23.0	93.0	0.0113	3.136	4.4
	<i>Cheilio inermis</i>	semi-elongated	12	0.997	5.8	23.7	0.0035	3.082	8.5
	<i>Choerodon graphicus</i>	cylindrical	140	0.998	4.0	51.5	0.0151	3.122	9.3
	<i>Coris</i> spp.	cylindrical	20	0.998	5.2	55.0	0.0065	3.254	8.3
	<i>Coris aygula</i>	cylindrical	11	0.992	32.5	55.0	0.0027	3.489	5.2
	<i>Epibulus insidiator</i>	compressed	19	0.985	8.7	35.0	0.0161	3.081	11.6
	<i>Gomphosus varius</i>	odd	22	0.995	5.0	21.2	0.0244	2.703	8.6
	<i>Halichoeres</i> spp.	cylindrical	80	0.980	3.1	19.3	0.0160	2.987	13.7
	<i>Halichoeres argus</i>	cylindrical	18	0.965	3.1	10.1	0.0175	2.957	14.9
	<i>Halichoeres melanurus</i>	cylindrical	26	0.949	3.6	10.6	0.0093	3.262	19
	<i>Halichoeres trimaculatus</i>	cylindrical	22	0.994	3.5	16.0	0.0275	2.736	10.8
	<i>Hemigymnus melapterus</i>	cylindrical	22	0.997	6.2	34.5	0.0242	2.923	7.1
	<i>Labroides dimidiatus</i>	semi-elongated	36	0.981	4.5	11.3	0.0059	3.231	10.1
	<i>Stethojulis</i> spp.	cylindrical	170	0.959	2.5	11.5	0.0185	2.892	7.1
	<i>Stethojulis bandanensis</i>	cylindrical	23	0.922	3.0	10.0	0.0304	2.581	25.9
	<i>Stetholulus interrupta</i>	cylindrical	24	0.960	3.1	9.0	0.0292	2.608	23.1
	<i>Stethojulis strigiventer</i>	cylindrical	147	0.971	2.5	11.5	0.0191	2.876	12.6
	<i>Thalassoma</i> spp.	cylindrical	158	0.956	2.8	17.6	0.0123	3.097	24.4
	<i>Thalassoma hardwicke</i>	cylindrical	10	0.997	5.5	16.3	0.0178	2.978	7.0
	<i>Thalassoma lunare</i>	cylindrical	85	0.977	2.8	16.5	0.0211	2.832	15.4
	<i>Thalassoma lutescens</i>	cylindrical	51	0.994	4.5	17.6	0.0130	3.042	7.6
Leiognathidae		very-flat	1024	0.985	2.5	21.0	0.0187	3.110	13
	<i>Gazza minuta</i>	very-flat	151	0.993	2.5	21.0	0.0327	2.876	8.8
	<i>Leiognathus</i> spp.	very-flat	856	0.983	2.5	20.0	0.0157	3.187	11.8
	<i>Leiognathus bindus</i>	very-flat	127	0.959	3.0	9.0	0.0263	2.897	8.9
	<i>Leiognathus equulus</i>	very-flat	380	0.993	2.5	20.0	0.0270	2.980	9.2

Family	Name	Shape	N	r	L.min	L.max	a	b	%error
Leiognathidae	<i>Leiognathus fasciatus</i>	very-flat	61	0.994	5.0	15.5	0.0200	3.102	8.2
	<i>Leiognathus leuciscus</i>	very-flat	59	0.977	5.0	9.0	0.0070	3.488	7.5
	<i>Leiognathus rivulatus</i>	very-flat	39	0.961	6.0	10.0	0.0192	3.008	6.5
	<i>Leiognathus splendens</i>	very-flat	161	0.974	4.5	11.5	0.0288	2.949	8.3
	<i>Secutor ruconius</i>	very-flat	17	0.921	3.5	6.5	0.0268	2.969	13.3
Lethrinidae		heterogeneous	8527	0.996	2.5	86	0.0169	3.040	9.4
	<i>Gnathodentex aurolineatus</i>	cylindrical	53	0.983	8.5	20.5	0.0180	3.063	6.2
	<i>Gymnocranius</i> spp.	compressed	814	0.995	6.5	69.0	0.0302	2.909	5.9
	<i>Gymnocranius euanus</i>	compressed	372	0.991	10.0	49.0	0.0225	3.001	5.3
	<i>Gymnocranius grandoculis</i>	compressed	243	0.995	16.0	69.0	0.0320	2.885	6.5
	<i>Gymnocranius</i> sp. FAO	compressed	120	0.998	9.0	53.0	0.0276	2.933	4.5
	<i>Lethrinus</i> spp.	heterogeneous	7597	0.996	2.5	86.0	0.0165	3.043	9.6
	<i>Lethrinus atkinsoni</i>	compressed	2038	0.991	4.2	45.5	0.0178	3.057	6.3
	<i>Lethrinus genivittatus</i>	cylindrical	877	0.992	2.5	22.0	0.0179	2.995	8.3
	<i>Lethrinus harak</i>	cylindrical	111	0.997	6.0	32.0	0.0170	3.042	6.1
	<i>Lethrinus lentjan</i>	compressed	380	0.995	6.5	44.5	0.0197	2.986	5.5
	<i>Lethrinus miniatus</i>	cylindrical	59	0.991	18.5	54.5	0.0066	3.277	7.2
	<i>Lethrinus nebulosus</i>	compressed	2980	0.996	3.5	69.5	0.0187	2.996	6.1
	<i>Lethrinus obsoletus</i>	cylindrical	133	0.992	11.0	31.0	0.0173	3.026	7.5
	<i>Lethrinus olivaceus</i>	cylindrical	135	0.992	22.5	72.5	0.0294	2.851	8.8
	<i>Lethrinus ravus</i>	cylindrical	9	0.997	11.0	53.2	0.0141	3.065	9.5
	<i>Lethrinus rubrioperculatus</i>	cylindrical	661	0.985	16.5	39.5	0.0128	3.108	5.7
	<i>Lethrinus semicinctus</i>	cylindrical	155	0.993	3.0	29.0	0.0118	3.117	8.6
	<i>Lethrinus xanthochilus</i>	cylindrical	59	0.992	22.0	62.5	0.0201	2.964	7.7
	<i>Monotaxis grandoculis</i>	compressed	63	0.999	4.0	45.0	0.0230	3.022	7.3
Lutjanidae		heterogeneous	5281	0.994	4.0	92.0	0.0167	3.022	11.6
	<i>Aprion virescens</i>	cylindrical	121	0.980	22.5	88.0	0.0230	2.886	8.3
	<i>Lutjanus</i> spp.	heterogeneous	5107	0.993	4.0	77.0	0.0151	3.057	10.8
	<i>Lutjanus adetii</i>	compressed	269	0.991	18.5	47.0	0.0071	3.261	7.1
	<i>Lutjanus argentimaculatus</i>	cylindrical	308	0.997	5.5	68.0	0.0280	2.844	5.6
	<i>Lutjanus bohar</i>	cylindrical	510	0.997	4.0	75.0	0.0156	3.059	6.0
	<i>Lutjanus fulviflammus</i>	cylindrical	867	0.994	5.0	32.5	0.0205	2.960	6.6
	<i>Lutjanus fulvus</i>	cylindrical	318	0.994	4.0	31.0	0.0211	2.974	8.3
	<i>Lutjanus gibbus</i>	compressed	515	0.991	14.2	40.5	0.0131	3.138	6.3
	<i>Lutjanus kasmira</i>	cylindrical	127	0.983	4.0	26.0	0.0084	3.247	7.8
	<i>Lutjanus lutjanus</i>	cylindrical	68	0.994	8.5	28.0	0.0182	2.969	5.8
	<i>Lutjanus monostigma</i>	cylindrical	15	0.986	25.0	53.5	0.0222	2.913	9.4
	<i>Lutjanus quinquelineatus</i>	cylindrical	864	0.969	5.5	23.0	0.0146	3.100	9.9
	<i>Lutjanus rivulatus</i>	compressed	12	0.994	15.5	76.0	0.0084	3.260	11.8
	<i>Lutjanus russelli</i>	cylindrical	171	0.993	9.5	37.0	0.0166	2.978	7.8
	<i>Lutjanus sebae</i>	compressed	34	0.996	24.5	77.0	0.0116	3.152	4.8
	<i>Lutjanus semicinctus</i>	cylindrical	31	0.976	18.0	35.0	0.0040	3.428	8.1
	<i>Lutjanus vittus</i>	cylindrical	998	0.992	9.0	38.5	0.0125	3.075	7.5
	<i>Symphorus nematophorus</i>	cylindrical	41	0.983	44.5	92.0	0.0147	3.046	5.7
Megalopidae	<i>Megalops cyprinoides</i>	semi-elongated	35	0.993	17.0	47.0	0.0122	3.033	7.1
Microcanthidae	<i>Microcanthus strigatus</i>	compressed	14	0.956	9.2	15.0	0.0526	2.818	9.7
	<i>Paramonacanthus japonicus</i>	compressed	48	0.953	5.0	17.0	0.0219	2.889	13
Monacanthidae	<i>Pseudalutarius nasicornis</i>	compressed	209	0.955	8.0	13.5	0.0070	3.262	6.9
Monodactylidae	<i>Monodactylus argenteus</i>	compressed	203	0.993	2.0	18.5	0.0303	2.964	8.0
Mugilidae		cylindrical	2825	0.993	4.0	60.0	0.0127	3.046	7.0
	<i>Liza</i> spp.	cylindrical	1544	0.991	4.0	35.5	0.0141	3.023	6.5
	<i>Liza macrolepis</i>	cylindrical	806	0.992	6.0	29.0	0.0144	3.014	6.7
	<i>Liza melinoptera</i>	cylindrical	735	0.984	4.0	35.5	0.0133	3.045	6.7
	<i>Mugil cephalus</i>	cylindrical	182	0.996	6.5	48.5	0.0109	3.089	6.5
	<i>Valamugil</i> spp.	cylindrical	919	0.995	5.0	60.0	0.0088	3.148	10.7

Family	Name	Shape	N	r	L.min	L.max	a	b	%error
Mugilidae	<i>Valamugil buehanani</i>	cylindrical	680	0.995	7.0	60.0	0.0101	3.104	7.6
	<i>Valamugil engeli</i>	cylindrical	196	0.991	6.5	26.0	0.0058	3.287	8.9
	<i>Valamugil seheli</i>	cylindrical	38	0.996	11.5	43.5	0.0061	3.275	6.1
Mullidae		cylindrical	2902	0.987	3.5	41.0	0.0104	3.224	9.7
	<i>Mulloides</i> spp.	cylindrical	29	0.979	10	21.5	0.0074	3.293	12.9
	<i>Mulloides flavolineatus</i>	cylindrical	24	0.951	10	19.5	0.0120	3.101	7.6
	<i>Parupeneus</i> spp.	cylindrical	816	0.993	3.5	41.0	0.0145	3.130	10.1
	<i>Parupeneus barberinus</i>	cylindrical	19	0.998	8.0	41.0	0.0131	3.122	5.4
	<i>Parupeneus ciliatus</i>	cylindrical	92	0.997	3.5	24.5	0.0116	3.220	9.0
	<i>Parupeneus heptacanthus</i>	cylindrical	522	0.989	5.5	23.5	0.0169	3.078	6.9
	<i>Parupeneus indicus</i>	cylindrical	91	0.997	3.5	36.0	0.0142	3.114	11.7
	<i>Parupeneus multifasciatus</i>	cylindrical	53	0.981	3.5	22.8	0.0114	3.211	17
	<i>Parupeneus spilurus</i>	cylindrical	19	0.995	11.4	29.5	0.0192	3.022	4.6
	<i>Upeneus</i> spp.	cylindrical	2057	0.984	3.5	24.0	0.0103	3.215	7.5
	<i>Upeneus moluccensis</i>	cylindrical	955	0.975	6.5	17.0	0.0170	3.022	6.7
	<i>Upeneus guttatus</i>	cylindrical	21	0.990	8.0	13.5	0.0218	2.883	5.1
	<i>Upeneus australiae</i>	cylindrical	332	0.978	7.5	15.5	0.0130	3.112	7.2
	<i>Upeneus sulphureus</i>	cylindrical	38	0.948	11.0	17.0	0.0081	3.322	6.9
	<i>Upeneus tragula</i>	cylindrical	380	0.988	3.5	24.0	0.0137	3.068	8.0
	<i>Upeneus vittatus</i>	cylindrical	329	0.988	6.0	24.0	0.0072	3.354	8.5
Muraenidae		elongated	175	0.943	3.7	256.0	0.0047	2.614	43.4
	<i>Echidna</i> spp.	elongated	22	0.969	11.0	64.0	0.0003	3.352	13.9
	<i>Gymnothorax</i> spp.	elongated	99	0.922	3.7	120.0	0.0005	3.303	20
	<i>Gymnothorax fimbriatus</i>	elongated	20	0.993	11.0	44.0	0.0004	3.324	10.6
	<i>Thyrsoidea</i> spp.	elongated	40	0.995	22.0	223.5	0.0115	2.305	9.8
	<i>Thyrsoidea macrura</i>	elongated	37	0.995	22.0	223.5	0.0113	2.311	13.2
Nemipteridae		cylindrical	1539	0.984	3.5	27.0	0.0171	3.004	13.1
	<i>Nemipterus</i> spp.	cylindrical	869	0.974	11.5	27.0	0.0068	3.307	7.9
	<i>Nemipterus furcosus</i>	cylindrical	598	0.976	11.5	27.0	0.0060	3.357	8.7
	<i>Nemipterus peroni</i>	cylindrical	271	0.936	15.5	26.5	0.0079	3.251	8.2
	<i>Scolopsis</i> spp.	cylindrical	669	0.981	3.5	22.0	0.0157	3.054	17.1
	<i>Scolopsis bilineatus</i>	cylindrical	104	0.996	3.5	19.4	0.0138	3.174	8.3
	<i>Scolopsis taeniopterus</i>	cylindrical	563	0.980	7.0	22.0	0.0185	2.981	7.4
	<i>Opisthognathus</i> spp.	cylindrical	28	0.897	3.5	7.5	0.0231	2.452	13.9
Opistognathidae		odd	67	0.962	2.5	41.0	0.0853	2.577	26.4
Ostraciidae	<i>Lactoria</i> spp.	odd	24	0.890	7.5	30.0	0.4029	1.928	35.2
	<i>Lactoria cornuta</i>	odd	15	0.925	20.5	30.0	0.0065	3.168	7.6
	<i>Ostracion cubicus</i>	odd	20	0.998	2.5	41.0	0.1288	2.519	10.5
	<i>Tetrosomus gibbosus</i>	odd	23	0.970	5.0	26.0	0.1820	2.369	11.7
Pinguipedidae	<i>Parapercis</i> spp.	cylindrical	202	0.982	2.5	23.0	0.0133	2.943	9.5
	<i>Parapercis cylindrica</i>	cylindrical	159	0.971	2.5	13.0	0.0124	3.000	14.4
	<i>Parapercis hexophthalma</i>	cylindrical	15	0.996	7.0	23.0	0.0068	3.157	7.8
	<i>Parapercis xanthozona</i>	cylindrical	19	0.983	3.5	17.5	0.0133	2.890	14.1
Platycephalidae		cylindrical	113	0.988	6.0	52.0	0.0112	2.917	12.1
	<i>Cymbacephalus beauforti</i>	cylindrical	14	0.998	19.5	52.0	0.0040	3.211	4.5
	<i>Onigocia macrolepis</i>	cylindrical	39	0.988	6.0	17.0	0.0239	2.646	6.3
	<i>Onigocia spinosa</i>	cylindrical	26	0.990	6.0	19.0	0.0352	2.465	9.1
	<i>Thysanophrys chiltonae</i>	cylindrical	20	0.989	7.5	22.1	0.0027	3.347	9.9
Plesiopidae		cylindrical	57	0.923	3.5	10.5	0.0033	3.856	13.5
	<i>Assessor macneili</i>	cylindrical	27	0.934	3.7	7.0	0.0181	2.791	12.4
	<i>Plesiops coeruleolineatus</i>	cylindrical	23	0.943	3.5	10.5	0.0067	3.496	18.3
Polynemidae	<i>Polydactylus microstoma</i>	cylindrical	112	0.981	10.5	24.5	0.0135	3.117	6.5
Pomacanthidae		compressed	232	0.983	2.0	36.4	0.0584	2.718	15.5
	<i>Centropyge</i> spp.	compressed	210	0.968	2.0	13.5	0.0745	2.577	17.2
	<i>Centropyge bispinosus</i>	compressed	117	0.964	2.0	11.5	0.0920	2.458	15.3

Family	Name	Shape	N	r	L.min	L.max	a	b	%error
Pomacanthidae	<i>Centropyge tibicen</i>	compressed	77	0.979	2.0	13.5	0.0492	2.795	10.6
	<i>Pomacanthus sextriatus</i>	compressed	20	0.999	3.5	36.4	0.0669	2.724	3.7
Pomacentridae		heterogeneous	2262	0.969	1.5	17.8	0.0209	3.191	15.1
	<i>Abudefduf</i> spp.	compressed	135	0.987	5.0	15.5	0.0226	3.132	8.2
	<i>Abudefduf sexfasciatus</i>	compressed	98	0.981	5.0	15.0	0.0213	3.152	10.9
	<i>Abudefduf whitleyi</i>	compressed	34	0.996	5.0	15.5	0.0254	3.093	7.7
	<i>Amblyglyphidodon</i> spp.	compressed	34	0.952	4.5	10.5	0.0144	3.330	13.7
	<i>Amblyglyphidodon curacao</i>	compressed	18	0.986	4.5	10.5	0.0126	3.435	8.2
	<i>Amblyglyphidodon leucogaster</i>	compressed	14	0.926	6.5	10.4	0.0297	2.936	9.8
	<i>Amphiprion</i> spp.	compressed	71	0.978	2.2	12.9	0.0189	3.190	10.9
	<i>Amphiprion akindynos</i>	compressed	21	0.989	4.0	12.9	0.0316	2.930	9.9
	<i>Amphiprion melanopus</i>	compressed	32	0.961	2.2	10.8	0.0155	3.298	12.3
	<i>Amphiprion tricoloratus</i>	compressed	13	0.984	5.5	12.0	0.0385	2.904	12.3
	<i>Chromis</i> spp.	compressed	373	0.971	2.0	12.0	0.0229	3.175	13.3
	<i>Chromis atripectoralis</i>	compressed	24	0.989	3.5	9.0	0.0179	3.291	10.4
	<i>Chromis chrysura</i>	compressed	58	0.979	5.5	12.0	0.0228	3.222	8.1
	<i>Chromis fumea</i>	compressed	61	0.975	4.5	9.0	0.0144	3.351	8.6
	<i>Chromis iomelas</i>	compressed	9	0.986	3.5	6.5	0.0151	3.383	7.9
	<i>Chromis lepidolepis</i>	compressed	16	0.898	5.0	6.8	0.1950	1.939	6.3
	<i>Chromis ternatensis</i>	compressed	30	0.921	5.0	7.5	0.0160	3.408	8.7
	<i>Chromis viridis</i>	compressed	144	0.932	2.0	7.0	0.0351	2.900	16.0
	<i>Chrysiptera</i> spp.	cylindrical	107	0.931	3.5	8.2	0.0260	2.926	12.6
	<i>Chrysiptera taupou</i>	cylindrical	85	0.946	3.5	8.2	0.0220	3.001	13.5
	<i>Dascyllus</i> spp.	compressed	138	0.976	2.4	13.5	0.0462	2.911	9.8
	<i>Dascyllus aruanus</i>	compressed	112	0.944	2.4	6.5	0.0415	2.989	12.9
	<i>Dascyllus reticulatus</i>	compressed	16	0.971	3.3	8.0	0.0311	3.133	13.6
	<i>Dascyllus trimaculatus</i>	compressed	10	0.997	5.5	13.5	0.0313	3.043	5.7
	<i>Neoglyphidodon</i> spp.	compressed	50	0.981	4.0	10.8	0.0175	3.212	5.8
	<i>Neoglyphidodon nigroris</i>	compressed	10	0.991	6.5	10.6	0.0178	3.182	3.8
	<i>Neoglyphidodon polyacanthus</i>	compressed	37	0.980	4.0	10.8	0.0206	3.146	11.2
	<i>Neopomacentrus</i> spp.	cylindrical	171	0.944	1.5	7.0	0.0258	2.933	10.2
	<i>Neopomacentrus azysron</i>	cylindrical	21	0.974	3.5	6.9	0.0258	2.943	8.1
	<i>Neopomacentrus nemurus</i>	cylindrical	101	0.901	4.5	7.0	0.0259	2.913	9.4
	<i>Pomacentrus</i> spp.	compressed	898	0.955	2.0	14.5	0.0280	3.024	12.1
	<i>Pomacentrus adelus</i>	compressed	143	0.937	2.0	8.0	0.0176	3.292	10.6
	<i>Pomacentrus amboinensis</i>	compressed	128	0.974	2.5	10.5	0.0439	2.824	11.3
	<i>Pomacentrus chrysurus</i>	compressed	54	0.972	2.5	14.5	0.0264	3.083	12.1
	<i>Pomacentrus imitator</i>	compressed	10	0.952	6.3	9.2	0.0102	3.469	11.2
	<i>Pomacentrus lepidogenys</i>	compressed	36	0.977	4.5	8.0	0.0215	3.210	9.2
	<i>Pomacentrus melanopterus</i>	compressed	13	0.989	4.0	9.5	0.0116	3.387	10.5
	<i>Pomacentrus moluccensis</i>	compressed	38	0.903	5.0	7.6	0.0305	3.012	10.4
	<i>Pomacentrus pavo</i>	cylindrical	172	0.977	2.5	9.5	0.0252	2.972	10.4
	<i>Pomacentrus philippinus</i>	compressed	73	0.972	3.5	9.5	0.0231	3.058	10.8
	<i>Pomacentrus vaiuli</i>	compressed	84	0.973	2.5	8.5	0.0472	2.775	13.1
	<i>Teixeirichthys jordani</i>	cylindrical	50	0.970	7.0	10.0	0.0197	3.072	5.4
	<i>Stegastes</i> spp.	compressed	205	0.983	2.5	15.5	0.0395	2.989	10.3
	<i>Stegastes fasciatus</i>	compressed	11	0.897	8.5	12.0	0.0028	4.063	11.7
	<i>Stegastes lividus</i>	compressed	12	0.943	7.5	15.5	0.0652	2.741	13.8
	<i>Stegastes nigricans</i>	compressed	182	0.986	2.5	12.5	0.0384	3.010	9.4
Priacanthidae		compressed	119	0.996	4.5	38.0	0.0294	2.807	7.7
	<i>Heteropriacanthus cruentatus</i>	compressed	10	0.990	9.0	20.0	0.0279	2.823	8.2
	<i>Priacanthus hamrur</i>	compressed	106	0.995	4.5	33.0	0.0300	2.801	5.7
Pseudochromidae		cylindrical	106	0.923	2.7	8.1	0.0192	2.812	8.1
	<i>Pseudochromis</i> spp.	cylindrical	97	0.951	4.0	8.1	0.0096	3.167	8.4
	<i>Pseudochromis purpurascens</i>	cylindrical	72	0.954	4.0	8.1	0.0099	3.145	13.7

Family	Name	Shape	N	r	L.min	L.max	a	b	%error
Pseudochromidae	<i>Pseudochromis salvati</i>	cylindrical	22	0.885	4.9	7.7	0.0218	2.752	9.1
Scaridae		cylindrical	668	0.996	2.3	68.0	0.0222	2.971	12.6
	<i>Chlorurus sordidus</i>	cylindrical	158	0.997	2.3	37.0	0.0243	2.969	7.6
	<i>Leptoscarus vaigiensis</i>	cylindrical	21	0.996	3.5	19.6	0.0163	2.991	8.7
	<i>Scarus</i> spp.	cylindrical	637	0.996	2.3	68.0	0.0234	2.956	13.3
	<i>Scarus altipinnis</i>	cylindrical	19	0.997	11.0	44.5	0.0184	3.029	6.4
	<i>Scarus ghobban</i>	cylindrical	247	0.997	6.0	49.5	0.0165	3.041	6.7
	<i>Scarus niger</i>	cylindrical	13	0.997	15.0	43.0	0.0134	3.160	6.0
	<i>Scarus psittacus</i>	cylindrical	21	0.970	6.1	15.0	0.0105	3.319	12.9
	<i>Scarus rivulatus</i>	cylindrical	37	0.999	5.0	41.5	0.0175	3.074	6.8
	<i>Scarus schlegeli</i>	cylindrical	75	0.983	4.5	37.0	0.0231	2.969	9.7
Scatophagidae	<i>Scatophagus argus</i>	compressed	45	0.998	5.0	36.0	0.0345	2.948	5.3
Scombridae	<i>Scomberomorus commersoni</i>	cylindrical	49	0.996	19.0	100.0	0.0162	2.856	6.6
Scorpaenidae		heterogeneous	140	0.984	3.0	31.0	0.0246	2.908	15.1
	<i>Dendrochirus brachypterus</i>	cylindrical	32	0.990	4.0	12.0	0.0097	3.337	6.8
	<i>Pterois</i> spp.	cylindrical	10	0.995	3.5	31.0	0.0358	2.697	14.2
	<i>Scorpaenodes</i> spp.	heterogeneous	77	0.976	3.0	15.7	0.0169	3.138	7.4
	<i>Scorpaenodes guamensis</i>	cylindrical	38	0.971	3.5	10.8	0.0196	3.038	13.0
	<i>Scorpaenodes parvipinnis</i>	cylindrical	11	0.983	3.0	15.7	0.0254	2.999	16.1
	<i>Scorpaenodes scabra</i>	cylindrical	15	0.969	3.0	9.5	0.0245	2.960	16.0
	<i>Scorpaenopsis</i> spp.	heterogeneous	15	0.948	3.5	10.0	0.0131	3.261	24.0
		heterogeneous	3403	0.996	3.5	128.0	0.0134	3.031	11.7
	<i>Anyperodon leucogrammicus</i>	cylindrical	10	0.980	30.5	51.0	0.0014	3.548	8.3
	<i>Cephalopholis</i> spp.	cylindrical	378	0.995	4.8	50.0	0.0115	3.109	11.2
Serranidae	<i>Cephalopholis argus</i>	cylindrical	15	0.988	21.5	44.0	0.0093	3.181	7.2
	<i>Cephalopholis boenack</i>	cylindrical	149	0.988	4.8	30.5	0.0146	3.019	9.
	<i>Cephalopholis miniata</i>	cylindrical	94	0.973	23.0	46.0	0.0107	3.114	8.0
	<i>Cephalopholis sonnerati</i>	cylindrical	96	0.968	24.0	50.0	0.0066	3.277	8.9
	<i>Cephalopholis urodeta</i>	cylindrical	17	0.953	15.0	25.5	0.0282	2.818	8.4
	<i>Cromileptes altivelis</i>	compressed	10	0.983	13.0	45.0	0.0962	2.489	12.1
	<i>Epinephelus</i> spp.	heterogeneous	2712	0.996	3.5	128.0	0.0122	3.053	10.3
	<i>Epinephelus areolatus</i>	cylindrical	268	0.990	6.0	42.5	0.0114	3.048	8.0
	<i>Epinephelus caeruleopunctatus</i>	cylindrical	24	0.997	3.5	61.0	0.0180	2.938	10.5
	<i>Epinephelus cyanopodus</i>	compressed	232	0.994	9.5	76.0	0.0111	3.114	7.9
	<i>Epinephelus fasciatus</i>	cylindrical	165	0.985	8.9	36.5	0.0138	3.041	9.6
	<i>Epinephelus fuscoguttatus</i>	cylindrical	22	0.997	18.5	100.0	0.0134	3.057	6.1
	<i>Epinephelus howlandi</i>	cylindrical	83	0.997	5.7	39.0	0.0153	2.999	9.6
	<i>Epinephelus macrospilus</i>	cylindrical	56	0.994	11.0	41.0	0.0132	3.031	7.8
	<i>Epinephelus maculatus</i>	cylindrical	775	0.989	6.5	60.5	0.0110	3.062	7.5
	<i>Epinephelus malabaricus</i>	cylindrical	172	0.998	8.5	128.0	0.0121	3.052	7.8
	<i>Epinephelus merra</i>	cylindrical	291	0.995	5.5	25.0	0.0158	2.966	9.5
	<i>Epinephelus ongus</i>	cylindrical	43	0.995	8.5	37.0	0.0190	2.928	7.1
	<i>Epinephelus polyphkadion</i>	cylindrical	359	0.992	8.5	61.5	0.0083	3.166	7.8
	<i>Epinephelus rivulatus</i>	cylindrical	158	0.965	16.0	40.5	0.0114	3.086	7.3
	<i>Epinephelus coioides</i>	cylindrical	44	0.997	6.5	111.0	0.0099	3.102	10.8
	<i>Plectropomus</i> spp.	cylindrical	212	0.996	10.7	95.0	0.0107	3.086	7.2
	<i>Plectropomus laevis</i>	cylindrical	17	0.996	18.1	95.0	0.0059	3.238	8.6
	<i>Plectropomus leopardus</i>	cylindrical	191	0.995	10.7	91.0	0.0118	3.060	7.1
	<i>Pseudanthias hypselosoma</i>	cylindrical	35	0.990	5.0	9.5.0	0.0137	3.149	7.0
	<i>Variola louti</i>	cylindrical	41	0.995	20.0	66.0	0.0122	3.079	5.8
Siganidae	<i>Siganus</i> spp.	compressed	2065	0.987	2.0	38.0	0.0145	3.122	12.2
	<i>Siganus argenteus</i>	compressed	31	0.991	10.0	32.0	0.0109	3.154	8.5
	<i>Siganus corallinus</i>	compressed	9	0.996	9.0	19.0	0.0023	3.821	6.4
	<i>Siganus doliatus</i>	compressed	669	0.981	2.0	22.5	0.0104	3.272	6.1
	<i>Siganus fuscescens</i>	compressed	481	0.996	3.0	29.5	0.0137	3.068	7.2

Family	Name	Shape	N	r	L.min	L.max	a	b	%error
Siganidae	<i>Siganus lineatus</i>	compressed	817	0.997	5.5	35.0	0.0219	2.998	5.9
	<i>Siganus puellus</i>	compressed	11	0.998	5.5	24.0	0.0176	3.028	4.7
	<i>Siganus punctatus</i>	compressed	27	0.994	10.0	36.5	0.0095	3.276	7.7
	<i>Siganus spinus</i>	compressed	9	0.993	6.5	14.0	0.0150	3.093	6.7
Sillaginidae	<i>Sillago</i> spp.	cylindrical	469	0.991	3.5	31.0	0.0040	3.264	6.3
	<i>Sillago ciliata</i>	cylindrical	169	0.988	15.5	31.0	0.0028	3.396	7.2
	<i>Sillago sihama</i>	cylindrical	249	0.992	3.5	29.0	0.0051	3.180	9.1
Soleidae		very-flat	12	0.999	4.5	28.0	0.0064	3.286	6.6
	<i>Pardachirus pavoninus</i>	very-flat	10	0.999	4.5	28.0	0.0078	3.218	4.4
Sparidae	<i>Acanthopagrus berda</i>	compressed	295	0.996	5.0	36.0	0.0224	3.044	6.9
Sphyraenidae		semi-elongated	646	0.990	5.5	104.0	0.0058	3.013	10.9
	<i>Sphyraena</i> spp.	semi-elongated	646	0.990	5.5	104.0	0.0058	3.013	10.9
	<i>Sphyraena barracuda</i>	semi-elongated	179	0.981	19.0	63.0	0.0062	3.011	7.4
	<i>Sphyraena flavicauda</i>	semi-elongated	43	0.961	5.5	35.5	0.0044	3.083	11.2
	<i>Sphyraena forsteri</i>	semi-elongated	95	0.995	8.5	60.0	0.0053	3.034	6.3
	<i>Sphyraena novaehollandiae</i>	semi-elongated	23	0.987	19.0	28.0	0.0240	2.530	4.2
	<i>Sphyraena obtusata</i>	semi-elongated	23	0.940	19.0	26.5	0.0257	2.588	7.7
	<i>Sphyraena putnamiae</i>	semi-elongated	226	0.994	19.5	104.0	0.0075	2.931	6.6
	<i>Sphyraena waitei</i>	semi-elongated	34	0.992	19.0	31.0	0.0089	2.855	3.8
	<i>Sphyrna lewini</i>	cylindrical	30	0.991	38.0	91.0	0.0042	3.239	7.6
Sphyrnidae		heterogeneous	19	0.980	5.0	29.5	0.0044	3.694	35.5
Synanceiidae	<i>Inimicus didactylus</i>	cylindrical	14	0.994	6.5	21.5	0.0232	2.865	6.3
Syngnathidae	<i>Hippocampus</i> spp.	odd	9	0.882	7.0	13.0	0.0004	4.120	36.1
Synodontidae		cylindrical	1188	0.988	4.0	33.0	0.0089	3.028	15
	<i>Saurida</i> spp.	cylindrical	1038	0.986	4.8	33.0	0.0080	3.059	9.1
	<i>Saurida gracilis</i>	cylindrical	95	0.991	4.8	23.0	0.0066	3.165	10.1
	<i>Saurida nebulosa</i>	cylindrical	11	0.996	8.0	18.5	0.0058	3.214	6.8
	<i>Saurida undosquamis</i>	cylindrical	932	0.976	6.5	33.0	0.0063	3.134	9.2
	<i>Synodus</i> spp.	cylindrical	145	0.980	4.0	22.0	0.0085	3.078	16.1
	<i>Synodus dermatogenys</i>	cylindrical	43	0.984	8.0	16.5	0.0047	3.346	8.9
	<i>Synodus hoshinonis</i>	cylindrical	45	0.965	9.0	19.0	0.0018	3.662	11.6
	<i>Synodus variegatus</i>	cylindrical	37	0.992	5.0	22.2	0.0031	3.484	10.6
	<i>Terapon jarbua</i>	cylindrical	87	0.988	2.0	28.5	0.0132	3.131	10.8
Teraponidae		odd	282	0.993	2.0	76.0	0.0397	2.788	20.8
	<i>Arothron</i> spp.	odd	96	0.996	2.5	76.0	0.0352	2.901	12.5
	<i>Arothron hispidus</i>	odd	19	0.997	6.5	52.0	0.0634	2.756	10.4
	<i>Arothron immaculatus</i>	odd	10	0.993	4.0	32.5	0.0351	2.845	19.8
	<i>Arothron manillensis</i>	odd	32	0.992	3.5	33.0	0.0299	2.907	13.8
	<i>Arothron stellatus</i>	odd	24	0.998	5.0	75.0	0.0915	2.672	8.6
	<i>Canthigaster</i> spp.	odd	87	0.947	2.0	9.5	0.0424	2.822	10.0
	<i>Canthigaster solandri</i>	odd	10	0.990	3.0	7.5	0.0299	2.979	10.1
	<i>Canthigaster valentini</i>	odd	66	0.915	2.0	8.6	0.0367	2.943	20.9
	<i>Lagocephalus sceleratus</i>	cylindrical	94	0.997	9.0	72.0	0.0182	2.924	11.8
Trichiuridae	<i>Trichiurus lepturus</i>	elongated	105	0.974	18.0	110.5	0.0002	3.324	12.3
Trypauchenidae	<i>Ctenotrypauchen microcephalus</i>	semi-elongated	23	0.898	4.5	11.5	0.0144	2.568	13.7
Zanclidae	<i>Zanclus cornutus</i>	very-flat	11	0.985	6.5	15.0	0.0147	3.370	2.0